Rauen, as the Augury of ill fortune: & the Soule was

REDEVNT SATVRNIA REGNA.

Eclog. 4.

Out of *Virgil*, to ſhewe that nowe thoſe golden times were returned againe, wherein *Peace* was with vs ſo aduannced, *Reſt* receaued, *Libertie* reſtored, *Safetie* aſſured, and all *Bleſſedneſſe* appearing in euery of theſe vertues her perticular Triumphe ouer her oppoſite euill. This is the dumbe argument of the frame, and illuſtrated with this verſe of *Virgil*, written in the vnder freeze.

AEneid. lib. 11.

NVLLA SALVS BELLO - - -
PACEM TE POSCIMVS OMNES.

The ſpeaking parte was performed, as within the Temple where there was erected an Altar, to which at the approach of the K. appeares the *Flamen*

BRITISH MUSEUM

*MARTIALIS.

And to him.

GENIVS VRBIS.

The *Genius* we attired before: To the *Flamen* wee appoint this habit. A long Crimſon robe to witneſſe his nobility, his typper and ſleeues white, as reflecting on purity in his religion, a rich mantle of gold with a traine to expreſſe the dignity of his function.

Vpon

* One of the three *Flamines* that as ſome think *Numa Pōpilius* firſt inſtituted, but we rather with *Varro* take him of *Romulus* inſtitution, whereof there were onely two,

Rauen, as the Augury of ill fortune: & the Soule was

REDEVNT SATVRNIA REGNA.

Eclog. 4.

Out of *Virgil*, to ſhewe that nowe thoſe golden times were returned againe, wherein *Peace* was with vs ſo aduannced, *Reſt* receaued, *Libertie* reſtored, *Safetie* aſſured, and all *Bleſſedneſſe* appearing in euery of theſe vertues her perticular Triumphe ouer her oppoſite euill. This is the dumbe argument of the frame, and illuſtrated with this verſe of *Virgil*, written in the vnder freeze.

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Vpon

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72a

A SHORT TREATISE OF DIALLING:

SHEWING,
THE MAKING OF ALL
ſorts of Sun-dials, Horizontal, Erect,
Direct, Declining, Inclining, Reclining; vpon
any flat or plaine ſuperficies, howſoeuer placed,
with ruler and compaſſe onely, without
any Arithmaticall calculation.

(*.*)

By EDVVARD WRIGHT.

K

LONDON,
Printed by *Iohn Beale* for WILLIAM WELBY.
1614.

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The Contents of this Booke.

Chap. 1. *The making of the Clinatory.*

Chap. 2. *The firſt diuiſion of dials into Horizontall, erect inclining, and reclining.*

Chap. 3. *The ſecond diuiſion of Dials into direct & declining.*

Chap. 4. *The third diuiſion of Dials, either agreeing with the plaine of the Meridian, or diſagreeing from the ſame.*

Chap. 5. *To find the eleuation of the meridian line aboue the Horizon.*

Chap. 6. *The deſcribing of the figure of the dial firſt on paper; paſteboard.*

Chap. 7. *The making of Æquinoctial Dials.*

Chap. 8. *The finding of the ſubſtilar line, and ſtile, in grounds not Equinoctial direct, aud Polar.*

Chap. 9. *The finding of the diſtance of the ſtile from the Meridian line in dials, that be neither equinoctial nor polar.*

Ch. 10. *The finding of the ſubſtilar line & the diſtance of the ſtile frõ it, when the ſtile maketh a right angle with the merid. line.*

Chap. 11. *From which end of the Meridian line the eleuation of the ſtile is to be counted.*

Chap. 12. *The finding of the ſubſtilar line & ſtile in dials that be not Polar nor Equinoctial the ſtile making oblique angles with the Meridian line.*

Chap. 13. *The drawing of the line of contingence, and of the Equinoctial circle, and how it muſt be diuided.*

Chap. 14. *The drawing of the houre lines in all dials that be not Æquinoctiall.*

Chap. 15. *What number muſt be ſet to the houre lines.*

Cha. 16. *What houre lines are to be expreſſed in all ſorts of dials.*

Chap. 17. *How to tranſlate the dial drawne on paper, or paſteboard vnto the dial ground.*

		line.	Errat,	Correct.
B2	b	28	neither	nether
B3	b	2	cliniatorie	clinatory
B3	b	2	line	line
B3	b	10	made	make
B4	a	12	alother	all other
B4	b	14	horozontal	horizontal
C1	b	21	liaueth	leaneth
C3	a	25	ground	grounds
C3	a	29	drawe	drewe
D1	a	25	neather	nether
D3	a	20	contingency	contingence
D4	b	2	gency	gence
E1	a	8	uſuſt	muſt
E1	b	23	night ſrom thencet	night: from thence
E2	a	17	zerſection	terſection
E2	b	4	continue	conteine
E3	a	8	as the	in the
E3	a	9	in the	as the
E3	a	15	nto	into
E3	b	12	on the	one on the
E3	b	14	baſtbord	paſtborde.

Alſo in the Diagramme placed there, and in the leafe following, let K & F be chaged each into others place.

IT is alſo to be remembred that there ſhould haue been numbers ſet to euery one of the figures, or pictures of the dials, adioined to the end of this treatiſe, beginning at E4 b, as there is to the three laſt, *viz.* the 16. 17. and 18. figure. As in the 7. Chap. where I ſhewe the making of Aequinoctial dials ſect 4. when I referre you to the firſt and ſecond figure, I meane the figues or pictures of the Aequinoctial dials in E4 b. To the firſt of theſe therfore there ſhould be ſet [1. *Figure*, to the next [2. *Figure*, and to the firſt of the polar dials in F1 b, there ſhould be ſet [3. *Figure*, and to the next in F2 a [4 *Figure* &c.

Alſo in the 18. figure the line F. E. ſhould haue beene continued vpwards ſo much longer, and it is between R. and E, and at the end thereof being ſo continued the letter g ſhould be ſet.

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A TREATISE OF DIALLING

CAP. I.

The making of the Clinatory.

1 Dials are diuerſly made according as they are diuerſly placed. Therefore their ſituation muſt firſt be knowne: which may be done by an inſtrument not vnfitly called a Clinatory.

2 Let this inſtrument be made iuſt foure ſquare, and let the thickneſſe bee about halfe a quarter of the breadth of it, vpon one ſide thereof deſcribe a quadrant, whoſe two ſemidiameters or ſides muſt be paralel to the ſide of the quadrate.

3 The quadrant muſt bee diuided into 90. degrees, with figures ſet to euery fifth or tenth degree (as the manner is) both forward and backward, and without the peripherie thereof, a groofe or furrowe muſt be made ſo deepe that

a plummet hanging by a thrid from the Center of the quadrant may fall into it, in ſuch ſort that the thrid may come cloſe to the degrees of the quadrant.

4 Cloſe within the limb of this quadrant make a great round hole or box, for the placing of a magneticall needle within the ſame, whoſe true Meridian line muſt bee perpendicular to one of the ſides of the quadrant, which ſhall be called the North ſide, and the other ſide of the quadrant ſhall bee called the Eaſtſide, to the which the Weſtſide of the Clinatory is oppoſite, as the South ſide of the Clinatorie is oppoſite to the Northſide of the quadrant: and the magneticall Meridian, muſt bee drawne in the bottome of the box according to the variation of the place where you are.

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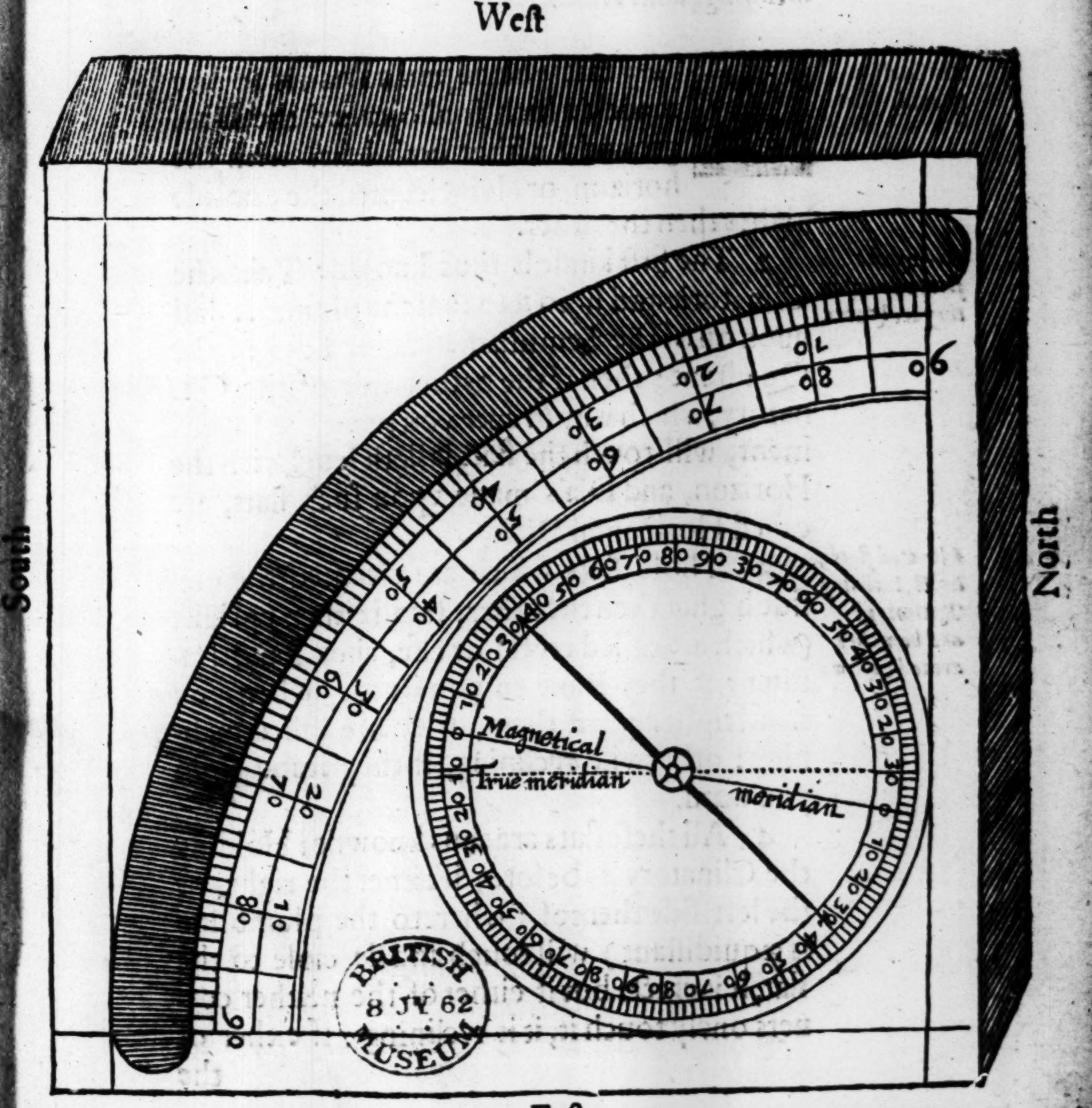
The figure of the Clinatory.



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CAP. II.

The firſt diuiſion of Dials into Horizontall, erect inclining, and reclining.

The Dial ground.

EVery flat whereupon a Diall is to bee made (which is alſo called the Diall ground) either lieth leuel with the horizon, or els is eleuated the one ſide higher then the other.

Horizontal flats: and how they are known.

2 The firſt kinde is thus known: Take the Clinatorie and hold it ſo that the plummet fall vpon on of the Semidiameters, or ſides of the Quadrant: then if the nether ſide of the Clinatory, which way ſo euer you turne the inſtrument, will touch the flat, it lieth leuel with the Horizon, and Dials made vpon ſuch flats, are called Horizontal Dials.

Eleuated flats; Erect, Inclining Reclining: and how they are to be known

3 Thoſe flats which are elenated the one ſide higher then the other, ſtand either vpright (which are called erect) or elſe, they ſtand leaning: if they leane to you ward, when you ſtand right againſt them, they are called inclining: otherwiſe reclining, if they leane from you ward.

4 All theſe flats are thus knowne: Holding the Clinatory as before; if either the right, or the left ſide thereof (whereto the plumbline is æquidiſtant) will touch and lie cloſe to the flat, it is erect: but if either of the neither corners onely touch it, it is reclining: if either of

the vpper corners onely touch it, it is inclining.

5 And how much the reclination or inclination is, you ſhall know after this manner.

6 Set one of the ſides of the Clinatory to the flat, in ſuch ſort, that the plumbline hanging at liberty, may fall vpon the circumference of the quadrant: for then the arke of the quadrant, betwixt the plumbline and that ſide of the quadrant that is parallell, or æquidiſtant to the flatte, is the reclination thereof, if the center of the quadrant be from the flat, or elſe the inclination, if it bee towards the ſame.

To know how much the reclination or inclination is.

CAP. III.

The ſecond diuiſion of Dials into direct and declining.

ALl flats are either direct, or declining.

2 All flats lying leuel with the Horizon are direct.

3 But if the flat lie not leuel with the Horizon: you ſhall thus know whether it be direct or declining. Firſt, draw therein a line parallel to the Horizon, after this manner: holde the Clinatory to the flat in ſuch ſort, that the plumbline may fall vpon one of the ſides of the quadrant; then draw a line by the nether ſide of the Clinatory in recliners; or by the vpper ſide in incliners; or by either of thoſe ſides in erect flats, for that line ſhall be parallel or æquidiſtant to the Horizon, and may

be called the Horizontall line. Set the North ſide of the Cliniatorie to this liue, if the North end of the needle looke towards the flat: then if the Magnetical Meridian be right vnder the needle, it is a direct flat: bnt if it differ from it, it is declining, and that ſo much as that difference is, and that way which the North end of the needle declineth from the Northend of the Meridian line in the clinatory.

4 If the Southend of the needle looke towards the flat, made your account contrarywiſe.

CHAP. IV.

The third diuiſion of Dials, either agreeing with the plaine of the Meridian, or diſagreeing from the ſame.

ALl flats doe either agree with the plaine of the Meridian circle (which may therefore bee called meridian flats) or elſe they diſagree from the ſame.

2 They are knowne thus: If the flat bee erect and declining 90. degrees, it is a Meridian flat, otherwiſe it is no Meridian flat; and then you muſt firſt draw therin the meridian line, after this maner.

How to drawe the Meridian line, in Horizontall flats.

3 If the flat be Horizontal, take the clinatory and lay it flat downe thereupon; and turning it about till the needle hang preciſely ouer the Magneticall meridian, by that ſide thereof that is parallel to the true Meridian line of the Clinatory, drawe a right line, for that ſhal be the Meridian line deſired.

4 In erect flats the Meridian line is perpendicular, and therefore laying the Clinatory cloſe to

ſuch a flat in ſuch ſort that the plumbline hang preciſely on either ſide of the quadrant, a line drawne by the ſide of the clinatory, parallel to that ſide of the quadrant, ſhall be the meridian line.

In erect flats.

5 - In direct flats, a line perpendicular to the line æquidiſtant from the Horizon, is the Meridian line we ſeeke for.

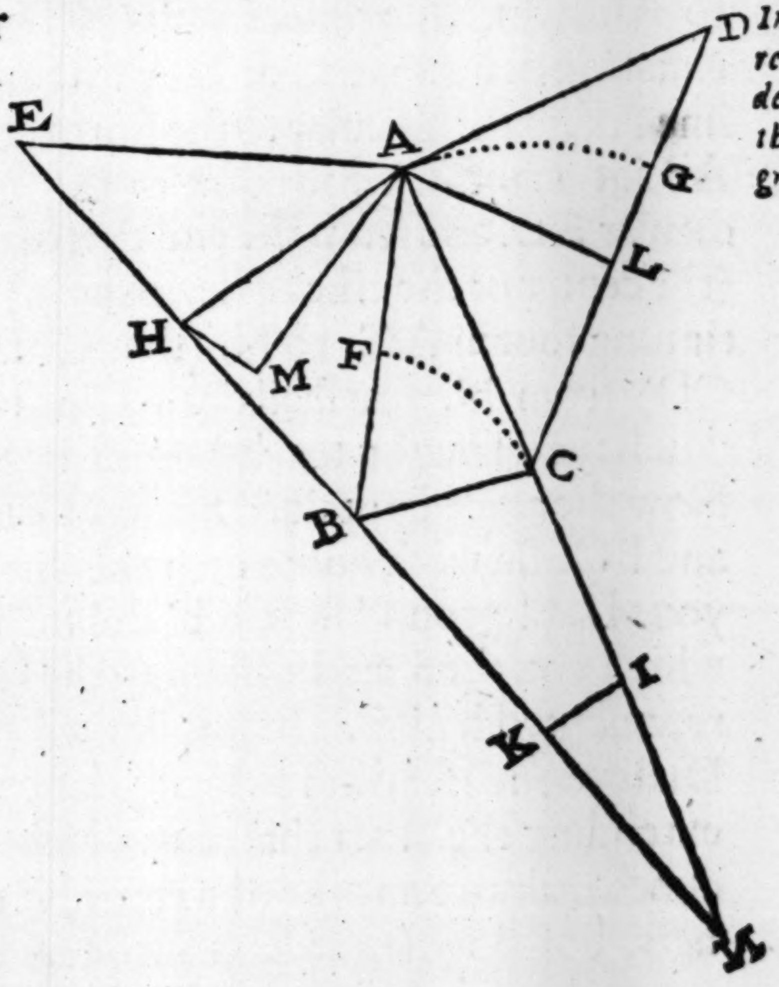
In direct flats.

6 In flats reclining or inclining, declining alſo 90.degrees (which are commonly called, Eaſt, or Weſt reclining or inclining) the meridian line is parallel to the horizon.

In reclining or inclining flats, declining 90. degrees.

7 For alother inclining or reclining, & withall declining flats, drawe a line vpon ſome paſtbord or paper which ſhall bee called the horizontal meridian A B. wherein ſetting one foot of your cõpaſſes, with the other draw an arch of a circle; & therin reckon the complement of the declination

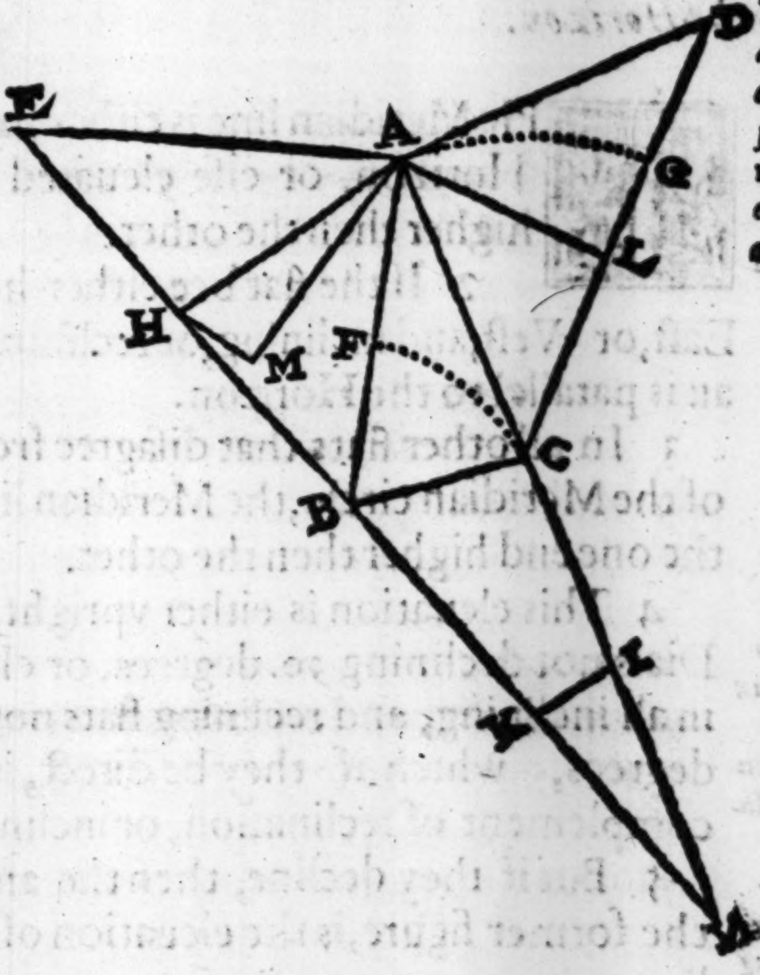
In inclining or reclining flats declining leſſe then 90. degrees.



declination FC. drawing a right line BC. by the end thereof out of the center B. This right line you ſhall croſſe ſquire-wiſe with another as AC. which may be called the baſe of inclination or reclination, and muſt alſo meet with the horizontall meridian at A. and ſetting one foot of your compaſſes in the croſſing at C. with the other foote draw an arke, counting therein the complement of the reclination or inclination AG. drawing a right line by the end therof, out of the center of the foreſaid ark CGD. & from A erect AD. perpendicular to AC. which may meet with CGD. the line of reclination or inclination at D. Alſo from A. draw the line AE. perpendicular to the horozontal meridian, AB. in the point A. and equal to the former perpendicular AD. and from the end therof draw a line to (the center of the arke of declination) B. Then continuing foorth AC. to N. (that CN. be equall to CD) from N. you ſhall draw a line to B. which (if you haue wrought truely) muſt be equall to BE. Now the angle contained betweene the lines NB. and BC. ſheweth how much the Meridian line in your Diall ground ſhould be diſtant from the line which you drew æquidiſtant to the Horizon heere repreſented by BC. In this line therefore (in the Dial ground) ſet one foote of your compaſſes, and extending the other that way which the Diall declineth, drawe an arke of a circle, vpwards in recliners, but downewards in incliners: and therein count the ſaid angle from the line parallel to the Horizon, and drawe by the end thereof a line, which ſhall bee the true Meridian in the Dial ground.

To finde the angle which the dial ground (or flat) maketh with the plaine of the meridian.

8 From A draw AH perpendicular to E B. make BI. equal to BH. from I. let IK be drawn perpendicular to BN. make CL. equal to CK and drawe a line from L to A. of theſe three lines A H. IK. and LA. make the triangle AHM. for then the angle AHM. is the angle which the dial ground maketh with the plain of the meridian.



CHAP. V.

To finde the eleuation of the Meridian line aboue the Horizon.

How to finde the eleuation of the meridian line.

THe Meridian line is either parallel to the Horizon, or elſe eleuated the one end higher then the other.

2 If the flat bee either horizontal, or Eaſt, or Weſt, and inclining, or reclining, the meridian is parallel to the Horizon.

3 In all other flats that diſagree from the plaine of the Meridian circle, the Meridian line is eleuated the one end higher then the other.

The eleuation of the meridian line in erect dials. In reclining or inclining direct flats; in reclining or inclining declining flats.

4 This eleuation is either vpright, as in all erect Dials not declining 90. degrees, or elſe leaning, as in all inclining, and reclining flats not declining 90 degrees, which if they be direct, is equall to the complement of reclination, or inclination.

5 But if they decline, then the angle ABE. in the former figure, is the eleuation of the Meridian line.

The eleuation of the meridian whether North or South.

6 If the meridian line bee not erect, it leaneth either Northwards, when the eleuated end thereof looketh towards the North, or elſe Southwards when the eleuated end looketh towards the South.

Flats polar.

7 All flats are either Polar (which being continued! would goe by the poles of the world) as all leaning flats, wherein the eleuation of the meridian line is Northwards, and equall to the poles eleuation: and all erect decliners 90, degrees. Otherwiſe they are no polar flats.

Not polar.

Chap. VI.

The deſcribing of the figure of the Diall firſt on paper or paſteboard.

NOw it ſhall bee beſt to take a ſheet of paper, or rather a paſtebord, that you may therein deſcribe the figure of your Dial, before you draw the Diall it ſelfe vpon his ground: that is, vpon the Truncke, Stone, wall, &c.

2 This paper, or paſteboord therefore, you ſhall place, or vnderſtand to be placed ſo as your Dial ground is or muſt be placed, and therein write the names of the parts of the world, as they lie in reſpect of your Dial ground, as Eaſt, VVeſt, North, South, Zenith, Nadir, vpper part, nether part, &c. which you may do by helpe of the magnetical needle: for the North end thereof (hanging at liberty) ſheweth the North, whereto the South is diametrally oppoſite; and your face being turned towards the North, your right hand ſheweth the Eaſt, your left hand the Weſt, the Zenith, or verticall point is aboue your head, the Nadir vnder your feete. Note alſo, which end of the Meridian line muſt be higher, and which lower; if the Meridian be not parallel to the Horizon.

CHAP. VII.

The making of Æquinoctiall Dials.

ALl Diall grounds are æquinoctiall, or not æquinoctiall.

2 An æquinoctiall ground is that which agreeth euen with the plaine of the æquinoctiall Circle: which is thus knowne. If the Diall ground be direct, and the Meridian line eleuated Southwards, equally to the complement of the poles eleuation, it is an Equinoctiall Diall ground, otherwiſe not.

3 In an Equinoctial Dial you ſhall deſcribe the houre lines after this manner.

How to make Equinoctial Dials.

4 Set one foot of your Compaſſes in the Meridian line AB. and with the other, drawe a circle DBC. and deuide it into 24. equall parts, as D.E. F.G. &c. beginning at B. the croſſing thereof, with the Meridian line; for then right lines, as AD. AE. AF. AG. &c. in the 1. and 2. figure drawne out of the Center, by thoſe diuiſions ſhall bee the houre lines.

Placing of the ſtile.

5 The ſtile muſt ſtand vpright out of the center of the Diall.

6 Of Equinoctiall Dials there be two ſorts, the vpper and the nether.

Vpper Equinoctial dial.

7 The vpper Equinoctial Dial looketh vpwards to the eleuated Pole of the world: And it ſheweth the houre of the day, onely in the *Spring* and *Summer* time, as in the firſt figure.

8 The nether, or lower Equinoctial dial, is that which looketh downwards to that Pole of the world which is beneath the Horizon, and ſheweth the houres onely in Autumne, and Winter, as in the ſecond figure.

Neather Equinoctial dial.

CHAP. VIII.

The finding of the ſubſtilar line, and ſtile, in grounds not Equinoctiall direct, and Polar.

IN all Dial grounds that are not Equinoctiall, the ſubſtilar line, and the diſtance of the ſtile from the ſubſtilar muſt bee found.

2 The ſubſtilar line is that, right over which the ſtile muſt be ſet.

Subſtilar line.

3 The diſtance of the ſtile from the ſubſtilar, is the angle, or ſpace contained betweene the ſtile, and the ſubſtilar line.

Diſtance of the ſtile from the ſubſtilar.

4 The finding out of theſe is divers, in divers kinds, and therefore muſt bee ſpecially ſhewed in each kinde.

The finding of the ſubſtilar line.

5 In direct Dial grounds not Equinoctiall, and Polars not Meridian, the ſubſtilar line is the ſame with the Meridian line, or elſe parallel thereto, in declining polars.

In direct flats not aequinoctial In Polars not Meridian.

6 In Polar ground, agreeing with the plaine of the Meridian, the ſubſtilar line may thus be found.

In Meridian Polars.

7 Set one foot of the compaſſes in the South-end of the line that you drawe equidiſtant from the Horizon and extending the other foot towards the

North

North end of the ſame line, draw an arke of a circle; therein reckon the eleuation of the Pole beginning at the foreſaid line: for a right line drawne thereby out of the center, ſhall be the ſubſtilar line AB. figure. 3.

The ſtiler line in all Polar Dials.

8 In al Polar grounds draw a parallel CD. (figu. 3.4.5.6.7.8.) to the ſubſtilar line at a conuenient diſtance from the ſame; for that ſhall be the line repreſenting the ſtile.

CHAP. IX.

The finding of the diſtance of the ſtile from the Meridian line in Dials that be neither equinoctial nor polar.

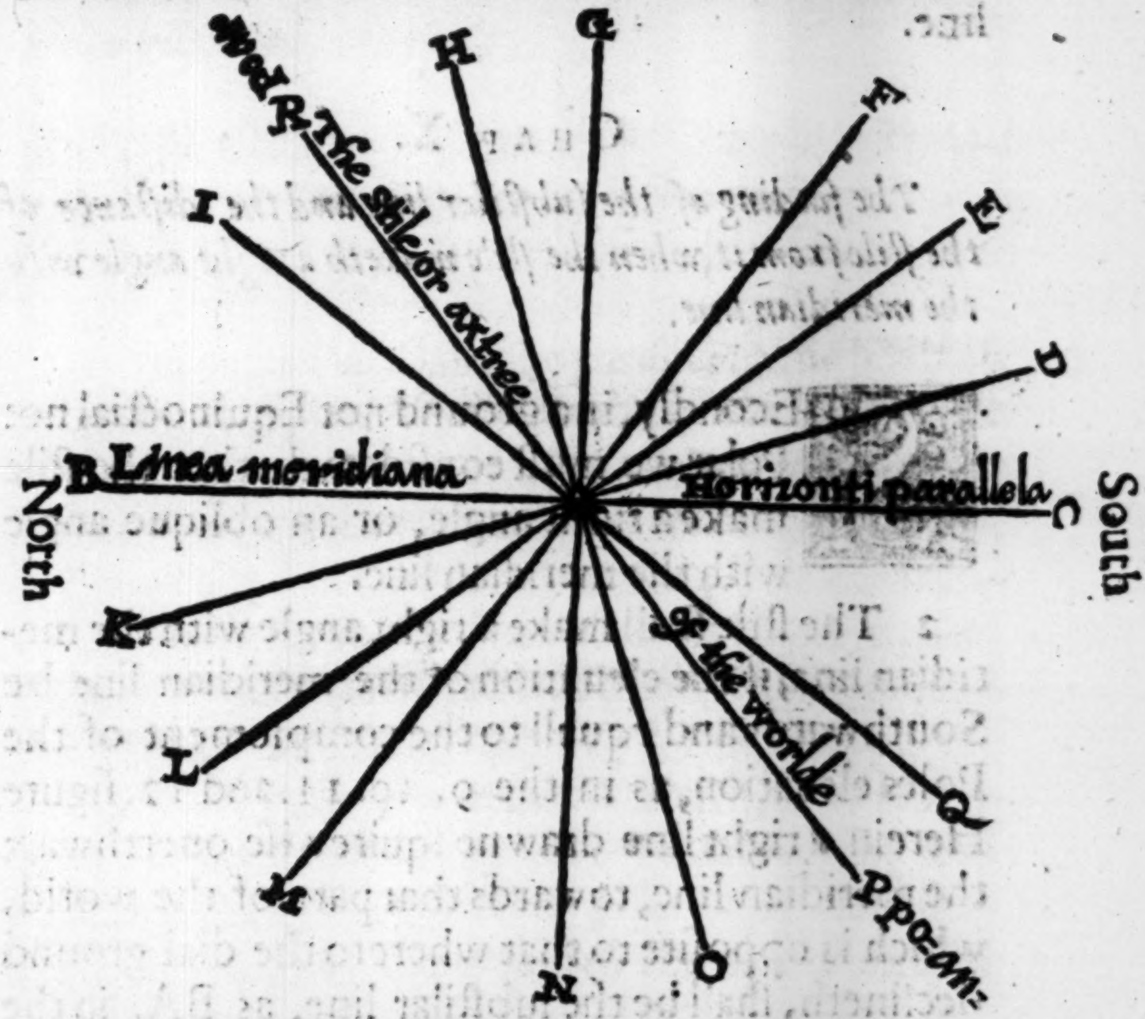
IN all Dial grounds that be not æquinoctiall nor polar, before the ſubſtilar line, and diſtance of the ſtile from it can be found, firſt the diſtance of the ſtile from the Meridian line muſt be found after this maner.

2 If the Meridian line be parallel to the Horizon, as BC. the diſtance of the ſtile from the Meridian line, is equal to the height of the Pole, as BR.

3 But if the eleuation of the Meridian be either vpright, as AG. or leaning towards the North, and withall greater then the Poles eleuation, as AH. the height of the Pole BR. taken out of the height of the Meridian line BH, or BG. ſhal leaue the diſtance of the ſtile from the Meridian line RH. or RG.

4 If the eleuation of the meridian line be Northwards, and leſſe then the height of the Pole, as BI.

take the eleuation of the meridian line B I. out of the height of the pole BR. and there ſhall remaine the diſtance of the ſtile from the Meridian line R I.



5 If the eleuation of the Meridian line be Southwards, and either greater, or equal to the complement of the Poles eleuation, as AF. and AE. then the complement of the Meridian lines eleuation, FG. or EG. added to the complement of the Poles eleuation GR. ſhall make the diſtance of the ſtile from the meridian line.

6 If the eleuation of the meridian line be Southward and leſſe then the complement of the poles

eleuatition as CD. the eleuation of the meridian line CD and the height of the Pole CP. put together ſhall make the diſtance of the ſtile from the meridian line.

CHAP. X.

The finding of the ſubſtilar line and the diſtance of the ſtile from it, when the ſtile maketh a right angle with the meridian line.

SEcondly, in a ground not Equinoctial nor Polar we muſt conſider whether the ſtile make a right angle, or an oblique angle with the meridian line.

2 The ſtile ſhall make a right angle with the meridian line, if the eleuation of the meridian line be Southwards and equall to the complement of the Poles eleuation, as in the 9. 10. 11. and 12. figure Herein a right line drawne ſquirewiſe ouerthwart the meridian line, towards that part of the world, which is oppoſite to that whereto the dial ground declineth, ſhall be the ſubſtilar line, as BA. in the 9. 10. 11. and 12. figu. aud the diſtance of the ſtile from the ſubſtilar line ſhal bee equall to the angle which the dial ground maketh with the plaine of the meridian circle as the angle BAD. fig. 9. 10. 11. 12. which angle is found by the third Chap.

CHAP. XI.

From which end of the Meridian line, the eleuation of the ſtile is to be counted.

IF the ſtile make an oblique angle with the meridian line, we muſt firſt finde out from whether end of the meridian line, the eleuation of the ſtile muſt be reckoned, thus:

2 If the meridian line be parallel to the horizon as in the 13. figure, the eleuation of the ſtile ſhal be reckoned from the North end of the meridian line in reclining, and horizontal flats looking vpwards, as BR. from B in the former figure, but contrariwiſe in incliners as PC. from C. in the ſame figure.

3 If the meridian line be eleuated the one end higher then the other from the horizon, and the dial ground looke towards the South, the eleuation of the meridian being alſo Northwards, and leſſe then the eleuation of the pole: the eleuation of the ſtile ſhal be counted from the vpper end of the meridian line: as IR. from I.

4 But if the eleuation of the meridian be greater then the eleuation of the pole, or vpright, or ſouthwards and greater then the complement of the poles eleuation; the eleuation of the ſtile ſhall bee counted from the neather end of the meridian line, as PM, PN, PO, from MNO.

5 If the eleuation of the meridian line be Southwards and leſſe then the complement of the poles eleuation, the eleuation of the ſtile ſhal be counted

from the vpper ende of the meridian line as DP. from D.

6 If the Dial ground looke toward the North, the eleuation of the ſtile from the meridian line ſhal be reckoned contrariwiſe in euery kinde.

CHAP. XII.

The finding of the ſubſtilar line and ſtile in Dials that be not Polar nor Equinoctiall, The ſtile making oblique angles with the Meridian line.

HAuing thus found out from whether end of the meridian line the eleuation of the ſtile is to be reckoned, ſet one foot of your compaſſes in the meridian line as in A. and ſtretching foorth the other foot towards that end of the meridian line, from which the eleuation of the ſtile is to bee reckned as towards L. draw an arch of a circle MDLN. and (beginning at the Merîdian line) reckon and marke therein the eleuation of the ſtile from the Meridian line, LD. figure 13.14.15. in the reſt LO. either Eaſtwards or Weſtwards in direct Dials, as in the 13. 14. 15. fig. but in decliners towards that part of the world which is oppoſite to the part whereunto the Dial declineth, as in the 16. 17. 18. fig.

2 Then in direct Dials, a right line ACD. fig. 13.14.15. drawne out of the center of the ſaid arke by the marke of the ſtiles eleuation from the meridian line ſhall be the line repreſenting the ſtile, and

therefore the diſtance of the ſtile from the ſubſtilar line ſhall be the diſtance of the ſtile, from the meridian line.

3 But in decliners you ſhall thus finde the ſubſtilar line: From O the point of the ſtiles eleuation from the meridian line in the foreſaid arke drawe OP. a perpendicular to the meridian line AL. and taking the length of this perpendicular with your compaſſes, leaue one foote in P. the concurſe thereof with the meridian line, and with the other deſcribe a quadrant of a circle QRO. beginning from the Meridian line, and ſo proceeding vnto O the other end of the perpendicular line; and in that quadrant beginning at the meridian ALQ. reckon and marke QR. the complement of the angle conteined betweene the plaines of the diall ground and of the meridian circle, and take with your compaſſes RS. the diſtance of that marke from the meridian line, and ſetting one foote of the compaſſes in P. the meeting of that perpendicular with the meridian line, with the other make a prick T, in the ſame perpendicular line: for then AB. a right line drawn by this prick T. out of the center of the foreſaid arke MDLN. ſhall bee the ſubſtilar line.

4 Then take with your compaſſes TR. the diſtance of the foreſaid marke in the quadrant, QRO. and this pricke, and leauing one foote of your compaſſes in the ſame pricke T. with the other make another pricke V. in the arke you firſt deſcribed; for then a right line AV. drawne thereby out of the

arch you firſt deſcribed ſhall bee the ſtilar line, or line repreſenting the ſtile.

5 In Dials not polar nor æquinoctiall, if the diſtance of the ſtile from the ſubſtilar line be but ſmal as in the fig. 10.12.17. it may bee increaſed by drawing a paralel CD. to the ſtile already found, which for diſtinctions ſake may bee called, the ſtile augmented.

The ſtile augmented.

CHAP. XIII.

The drawing of the line of Contingence, and of the Equinoctiall circle, and how it muſt be diuided.

NOw in all Dials that be not æquinoctiall, draw a right line, EHF. ſo long as you can, making right angles with the ſubſtilar line, which is called the line of contingence, or touchline.

2 Then deſcribe the Equinoctiall circle GHI. after this manner: Take with your compaſſes the ſhorteſt diſtance betweene H. the interſection of the line of contingence with the ſubſtilar line, and the ſtilar line, and leauing one foot in that interſection, with the other make a pricke B. in the ſubſtilar line, whereupon deſcribe a circle GHI. which ſhall be called the equinoctiall circle.

3 If the diſtance of the ſtile from the ſubſtilar be augmented, you muſt draw two touch lines and two æquinoctial circles: as in 10.12.17. figures.

4 The halfe of the æquinoctiall circle next the

line of contingence muſt be deuided into 12. equal parts, beginning at H, the interſection thereof with the ſubſtilar line in all direct dials, and erect or meridian polars which are commonly called Eaſt or Weſt dials erect, as in the 3.4.5.6.13.14.15. figures.

5 In polars not meridian nor direct, let HK, in fig. 7. & 8. (the complement of the angle which the dial ground maketh with the plaine of the meridian) be numbred and marked in the æquinoctial circle, beginning at the ſubſtilar line, and proceeding that way which the diall ground declineth as from H. to K. for at that marke K you muſt begin to diuide.

6 In decliners not polars, if the ſtile make a right angle with the meridian line, as in the 9. 10 11. 12. figu. a paralel to the line of contingence, drawne by the center of the æquinoctiall, ſhall ſhew the beginning of the diuiſion, as BK in figu. 9. 10. 11. 12.

7 But if the ſtile make an oblique angle with the meridian line, and the line of contingencye, cut the meridian line, as in the 16. figu. your ruler laid to that cutting at X and the center of the Equinoctial B. ſhal ſhew in the peripherie thereof, the beginning of the diuiſion K if the diſtance of the ſtile from the ſubſtilar be not augmented.

8 But if it be augmented (as in the 17. figure) the ſhorteſt diſtance HX betweene H the interſection of the touch line, with the ſubſtilar line, and the ſtile not augmented AV muſt bee taken with the compaſſes, and reſting one foot in that interſection H, with the other make a pricke Y in the

ſubſtilar line, towards B the center of the Equinoctiall; by which pricke Y & Z the mutuall interſectiō of the next touch line with the meridian line, let a right line YZ be drawne, for BK. and BK. paralels to it drawne out of the cenrers of both the Equinoctials, towards the meridian line, at their croſſings with the Equinoctials K & K ſhall ſhew the beginnings of their diuiſions.

9 But if the touch line cut not the meridian line as in the figure 18. let a paralel thereto XY bee drawne, which may cut the meridian line in Y and take with the compaſſes the ſhorteſt diſtance ZA betwixt the interſection thereof with the ſubſtilar line and the ſtile not augmented; and leauing one foote in that interſection Z, with the other make a pricke B in the ſubſtilar line towards the center of the Equinoctiall; from this pricke drawe a right line BY from B to Y the interſection of the ſaid paralel with the meridian line; for BK A paralel to this line drawne out of the center of the Equinoctiall B. ſhall ſhew the beginning of the diuiſion K.

CHAP.

CHAP. XIIII.

The drawing of the houre lines in all Dials that bee not Equinoctiall.

HAuing thus, deuided the Equinoctial circle, lay your ruler to the center thereof B. and to euery one of thoſe prickes γ.δ.ε.ζ. η.θ.ι.κ λ.μ.ν. by which it is deuided, and make marks ξ ο.σ.τ.υ.φ.χ.ψ.ω &c. in euery place where it croſſeth the line of contingence for then

2 In all polar Dials paralels to the ſubſtilar line, drawne by thoſe markes, ſhall bee the houre lines, as in the 3. 4. 6. 7. 8. figu.

3 In Dials not polar, in which the height of the ſtile is not augmented, right lines drawne out of the center of the dial by thoſe markes ſhal be the houre lines as in the 9. 11. 13. 14. 15. 16. 18. figu. And if any of the diuiſions of the æquinoctiall circle doe fall in to the ſubſtilar line, a paralel to the line of contingence drawne by the center of the ſaid diall, ſhall ſhew two oppoſit houres, diſtant by the ſpace of ſix houres from the ſubſtilar line ; as for example in direct Dials, ſix in the forenoone and ſix in the afternoone, as in the 13. 14. 15. figure. Alſo if the ruler laid to B. the center c. the Equinoctial circle, and ſome diuiſion thereof, as V in the 16. and 18. figu. cannot croſſe the line of contingence, and yet draweth neerer to it, : draw BY. a right line from the center of the Equinoctial by that diuiſion, and draw AF a paralel to that line,

which may croſſe the ſubſtilar and line of contingency in F. then let H A. the other part of the ſubſtilar that is betweene the line of contingence and the center of the dial A. be cut in ſuch ſort that the ſegments, of the ſubſtilar line concurring at the line of contingence AH and HB. may keepe the ſame proportion which the greater ſegments B H. and HA. haue, which are contained betweene the center of the Dial and line of contingence, and betwixt the center of the Equinoctiall and the line of contingence. And let a right line BF. bee drawne by that ſection B and the ſection of the line of contingence F. For AI a paralel to this right line drawne out of the center of the Diall ſhall be the houre line that wee ſeeke for.

4 In thoſe dials wherein the diſtance of the ſtile from the ſubſtilar is augmented, right lines drawne by thoſe markes in both lines of contingence which are proportionately diſtant from the ſubſtilar line ſhall be the houre lines.

CHAP. XV.

What number muſt be ſet to the houre lines.

IN meridian Dials, the ſubſtilar line is the line of the ſixth houre: but for the reſt, we muſt conſider whether it be an oriental or an occidental dial.

2 An oriental Dial looketh to the Eaſt, and the forenoone houres onely muſt bee ſet in this Dial, and therefore the ſubſtilar line ſheweth ſix of the clocke in the morning ; from which towards the South are the morning houres before ſixe, *viz.* 5.4. 3. &c. but towards the North after ſix, 7. 8. 9. 10. 11. as in the 3 figure.

3 An occidental Dial looketh directly Weſtwards : and onely the houres after noone can bee ſet into this dial. Therfore the ſubſtilar line ſheweth the ſixt houre after noone : from which toward the North are the houres before ſix in this order. 5.4. 3.2. 1. but towards the South after ſix thus. 7. 8.9. &c. as in the 4. figure.

4 In Dials not Meridian, if a ruler laid to the center of the æquinoctial and the beginning of the diuiſion thereof doe croſſe the touchline ; then the houre line drawne by that croſſing is the line of twelue a clocke. But if it cannot croſſe the touch line, imagine notwithſtanding, that croſſing and the twelue a clocke line, drawne thereby without the bounds of your Dial, whereabouts you thinke it would bee, if the ruler and touch line were

continued foorth long inough.

5 Then in al Dials not meridian, imagine the ſtile to be faſtned in his place, in æquinoctial Dials perpendicularly erected out of the Center. In Dials that be not Equinoctial, conceiue it to be placed exactly ouer the ſubſtilar line, ſo much raiſed from the ſame as the ſtilar line in your paper or paſtbord, is diſtant from the ſubſtilar line.

6 After this, place your paper or paſtebord (wheron the figure of your Dial is deſcribed) in the ſame ſite or poſition that the dial ground is, or muſt be placed; ſo that the quarters of the world, written thereupon, may anſwer in like poſition to the quarters of the world as they lie in reſpect of your dial ground: for then if the 12. a clocke line be towards the North, from the ſtile it is the line of the 12. houre of the day. From hence therefore towards the Weſt are the forenoone houres, 11.10. 9.8.7. &c. and toward the Eaſt, the afternoone houres, 1.2.3.4.5.6. &c.

7 But if the 12. a clocke line bee Southward from the ſtile, it is the line of the twelfth houre in the night from thence: therefore on both ſides are the night houres: toward the Weſt, after midnight, 1.2.3.4. &c. towards the Eaſt before midnight, 11.10.9.8.&c.

CHAP. XVI.

What houre lines are to be expreſſed in all ſorts of Dials.

IN al Dials, thoſe houre lines onely are to be expreſſed, vpon which the ſhadow of the ſtile ſhal fall. Therefore the houres of the day onely are to bee expreſſed.

2 In Dials not Polar, wherein the height of the ſtile is not augmented, if the ſtile point vpwards, and the eleuation thereof from the ſubſtilar line, bee not leſſe then the complement of the ſunnes greateſt declination, all the houre lines ſeruing for the longeſt day, are to be expreſſed therein.

3 But if the eleuation of the ſtile from the ſubſtilar be leſſe then the complement of the Sunnes greateſt declination, draw a right line out of the interſection of the line of contingence, and ſubſtilar perpendicularly ouerthwart the ſtilar line: and ſetting one foot of your compaſſes in the center of the dial, and extending the other towards the other end of the ſtilar line, draw an arke therefrom equal to the complement of the Sunnes greateſt declination: and thereby draw a line out of the center of the Dial, and ſetting one foot of your compaſſes in the interſection of this line with the foreſaid perpendicular, extend the other foot to the ſtilar line: Then keeping this diſtance, ſet one foote of your compaſſes in the center of the æquinoctial circle and with the other croſſe the line of contin-

gence on both ſides the ſubſtilar: now if you lay your ruler to theſe croſſes and the center of the Dial: right lines drawne thereby beyond the center of the Dial ſhal continue betweene them the ſpace wherein no houre lines are to be expreſſed.

4 This rule holdeth alſo in meridional Dials inclining, when the eleuation of the ſtile is counted from the vpper end of the Meridian line, and the eleuation of the ſtile from the ſubſtilar is leſſe then the complement of the Sunnes greateſt declination.

5 If the ſtile point downwards, no houre lines are to be expreſſed aboue a line parallel to the horizon drawne by the center of the Dial.

6 And if the croſſe in the line of contingence (made as before was ſhewed) be aboue the line æquidiſtant to the horizon, drawne by the center of the Dial; no houre lines are to be expreſſed aboue a right line drawne from the croſſe and continued beyond the center of the Dial.

7 If any part of the Dial whereupon the ſhadow of the ſtile may fal, bee void of houre lines: let the houre lines before deſcribed bee continued foorth into that part of the Dial, as in the 13 and 15 figure.

Chap. XVII.

How to tranſlate the Diall drawne on paper or paſteboard vnto the Dial ground.

THe figure of your Dial being thus deſcribed, you ſhall tranſlate the ſame into the Dial ground, after this manner.

2 Place the paper or paſtebord whereas the figure of your dial is deſcribed in ſuch ſort, in the Dial ground is placed, ſo as the quarters of the world written on the paper or paſtebord may anſwer in like poſition to the quarters of the world as they lye in reſpect of the Dial ground.

3 Then as the houre lines and ſubſtilar line are deſcribed in your paſtebord, ſo in like manner, and in like poſition, let them be inſcribed into your Dial ground that ſo little part of the ground as may be, be left voide of houre lines ſeruing for vſe, and that the ſpaces on both ſides from the ſubſtilar line drawne on the Dial ground bee proportionable to the number of houre lines that are to bee expreſſed in the Dial.

4 In Polar dials draw a right line ſquire-wiſe ouerthwart the ſubſtilar in the Dial ground; then take with your compaſſes the diſtances of the houre lines from the ſubſtilar in the paſtebord; and ſet them into that line drawne ſquire-wiſe in the Dial ground, ſetting alwaies on foot in the interſection thereof with the ſubſtilar line, and with the other foote making pricks in the ſaid line drawne ſquire-

wiſe: And let paralels to the ſubſtiar line be drawn by thoſe prickes, for they ſhall bee the houre lines we ſecke for, ſet into the dial ground.

5 The ſtile muſt be paralel to the ſubſtilar line, and muſt be placed directly ouer it, ſo much diſtant from the ſame, as the ſtilar line is diſtant from the ſubſtilar in the figure of your Dial drawne on the paſtbord or paper.

6 In Dials that be not polars, wherein the eleuation of the ſtile from the ſubſtilar is not augmented, deſcribe two peripheries of equal bigneſſe on the Dial ground, the center thereof being placed in the meridian line, the other vpon the center of the Dial in the baſtbord: then in this peripherie take the diſtances of the ſubſtilar and the houre lines from the Meridian with your compaſſes, out of the figure of your Dial in the paper or paſtbord, & ſet thoſe diſtāces likewiſe into the dial grounds, and by them draw the houre lines and the ſubſtilar from the center of the dial.

7 The ſtile muſt bee faſtned in the center, and muſt hang directly ouer the ſubſtilar, eleuated ſo much from the ſame, as the ſtilar line in the figure of your dial is diſtant from the ſubſtilar.

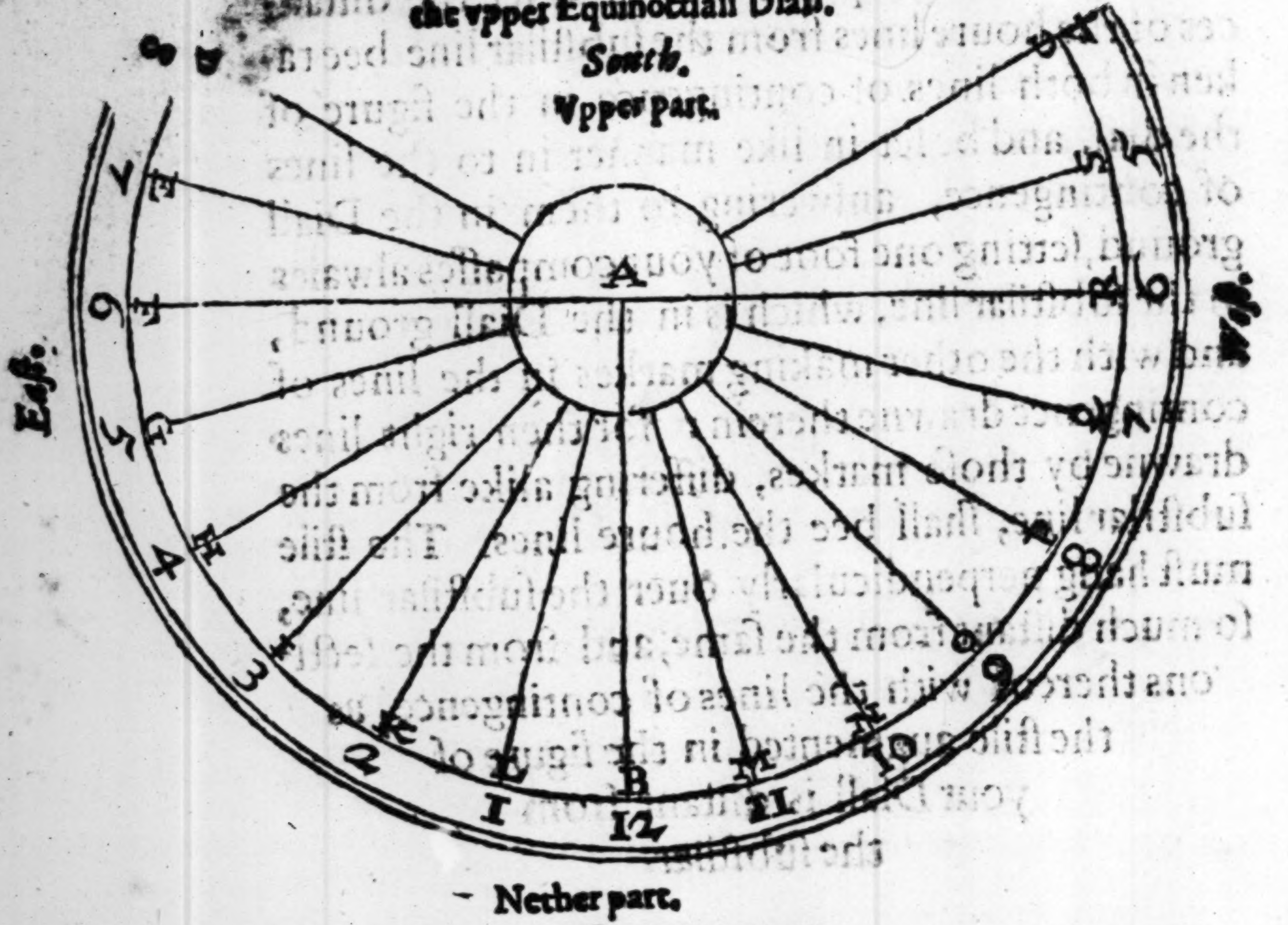
8 But in Dials that be not polars, wherein the eleuation of the ſtile from the ſubſtilar, is augmented, let the ſubſtilar line bee deſcribed in the Dial ground ſo much diſtant from the Meridian, which you firſt deſcribed therein, as the ſubſtilar is diſtāt from the Meridian in the figure of your dial. And let two lines of contingence be drawne ſquire-

wiſe ouerthwart that ſubſtilar in the Dial ground, ſo much diſtant each from other, as the lines of contingence in the paper are. And let the diſtances of the houre lines from the ſubſtilar line bee taken in both lines of contingence in the figure of the dial, and be ſet in like manner in to the lines of contingence, anſwering to them in the Diall ground, ſetting one foot of your compaſſes alwaies in the ſubſtilar line, which is in the Diall ground, and with the other making markes in the lines of contingence drawne therein: for then right lines drawne by thoſe markes, differing alike from the ſubſtilar line, ſhall bee the houre lines. The ſtile muſt hang perpendicularly ouer the ſubſtilar line, ſo much diſtant from the ſame, and from the ſections thereof with the lines of contingence, as the ſtile augmented in the figure of your Diall is diſtant from the ſubſtilar.

Equinoctiall

Equinoctiall Dials.

North direct reclining 51. degrees, 30. minutes, or the vpper Equinoctiall Diall.



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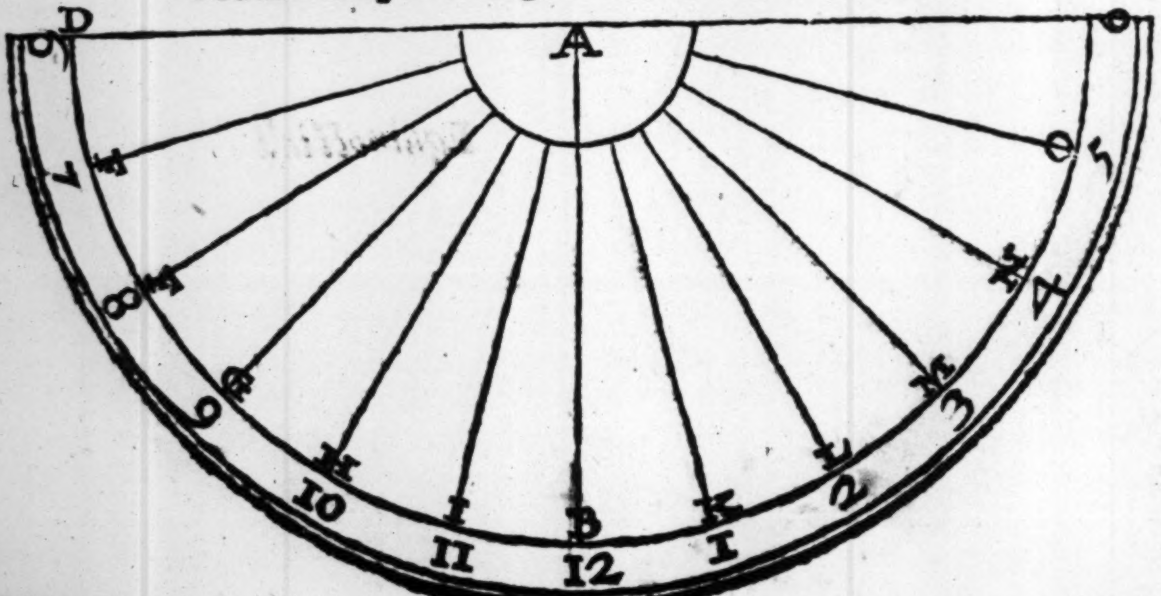
South direct, inclining 51. degrees, 30. minutes.

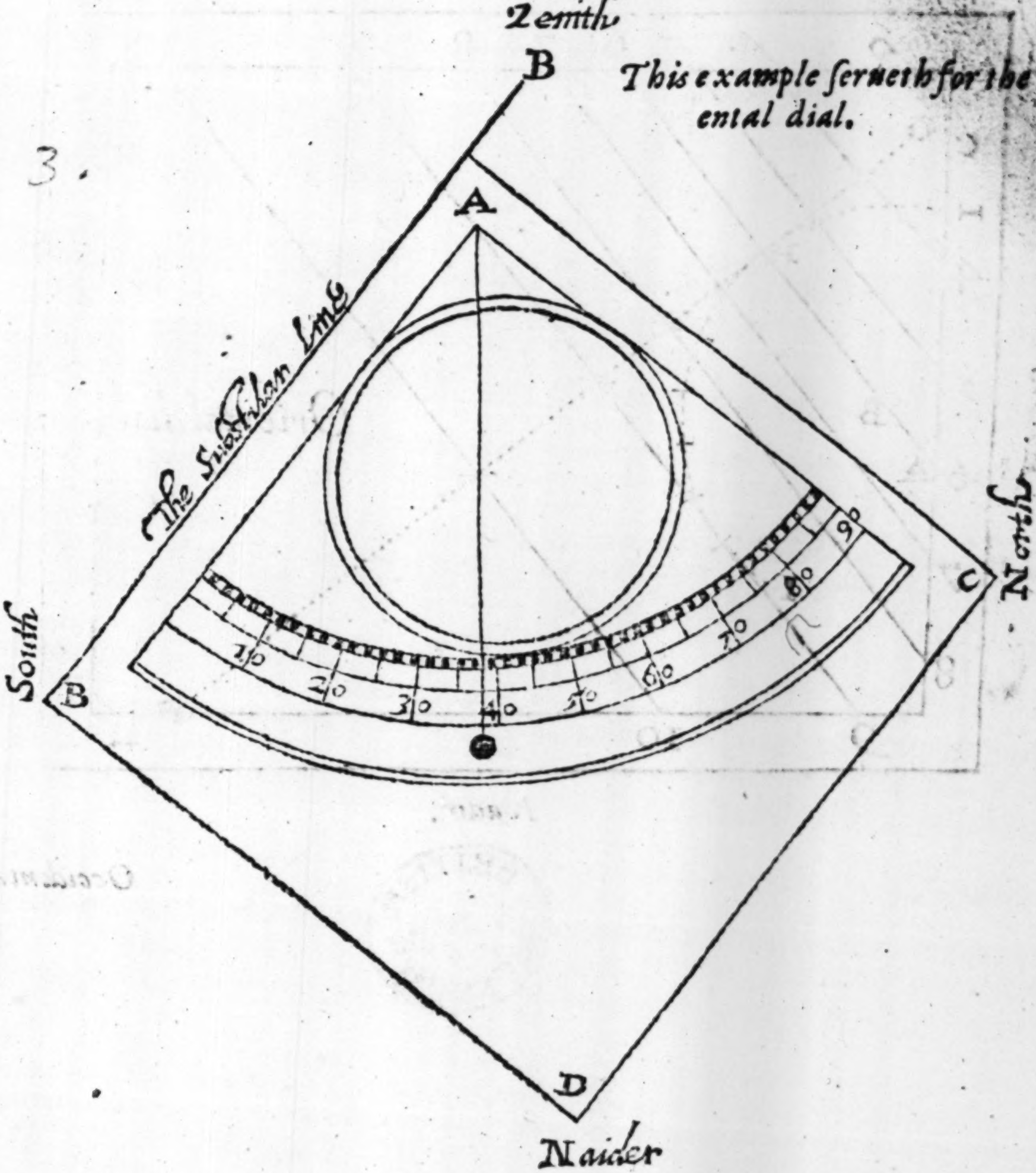


2

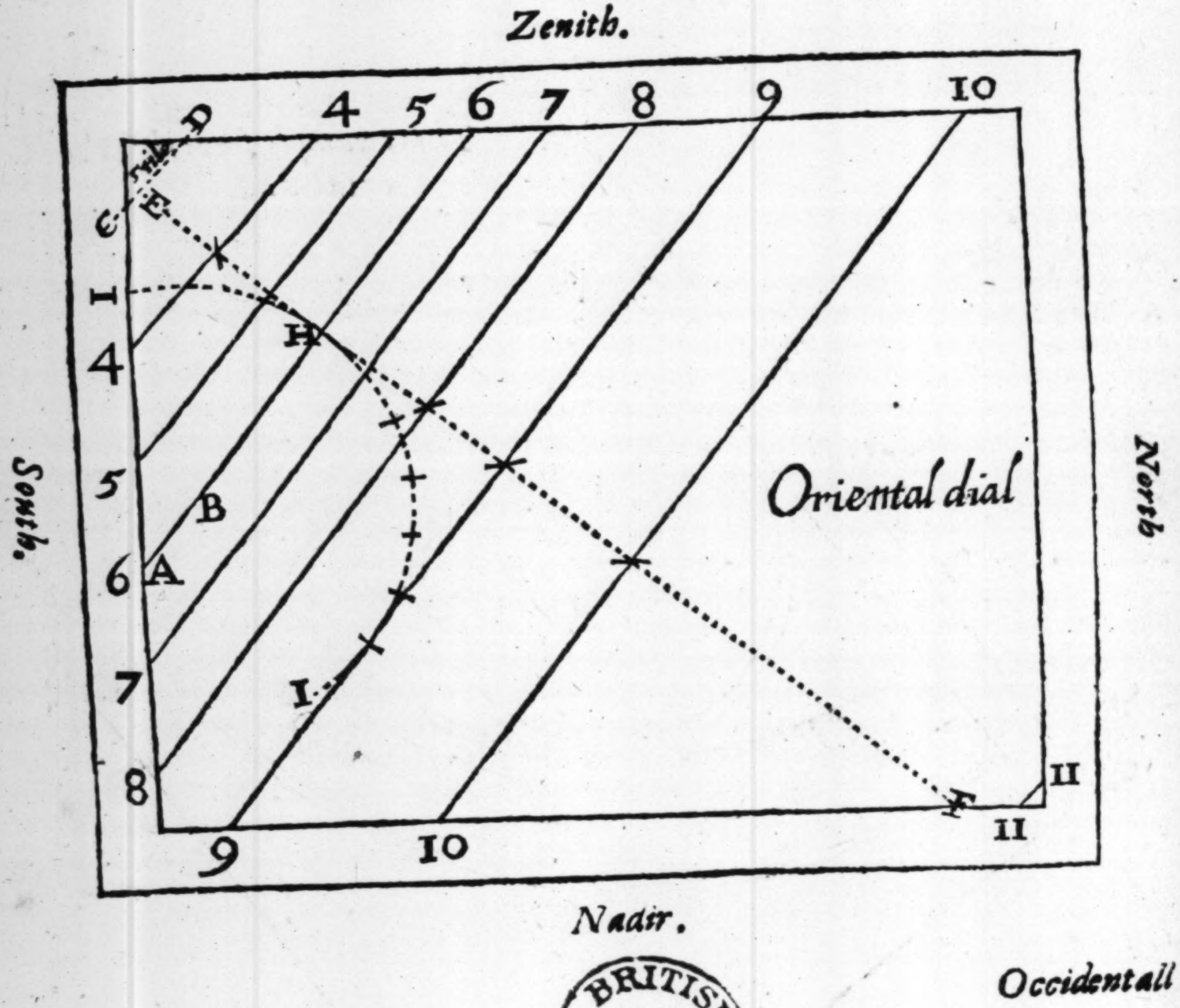
The manner of finding the ſubſtilar line in Meridian *Polar Dials.*

This example ſerueth for the Oriental dial.

3.



Meridian Polar dials.



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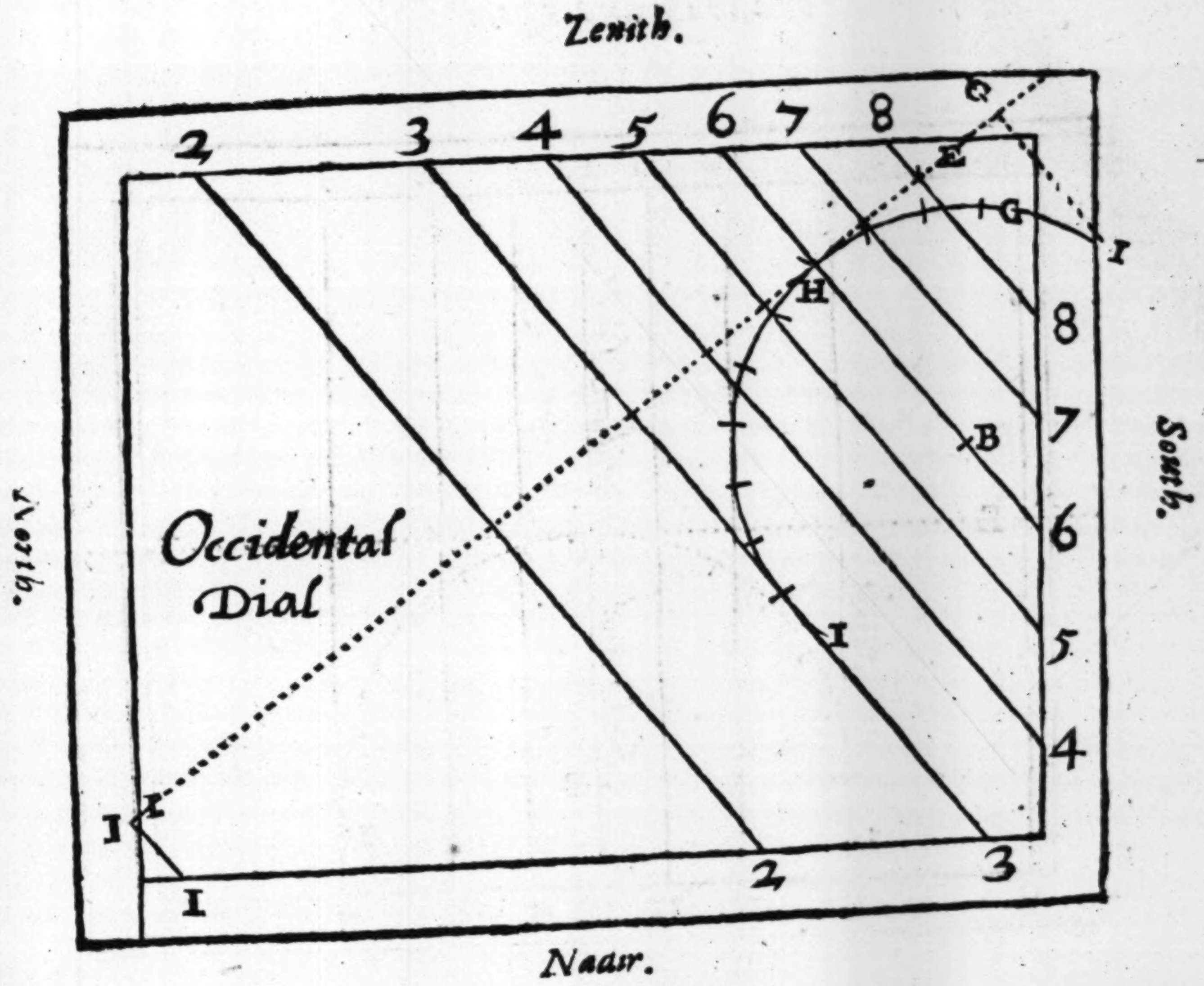
Zenith.
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South.
North.
Occidental Dial
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3
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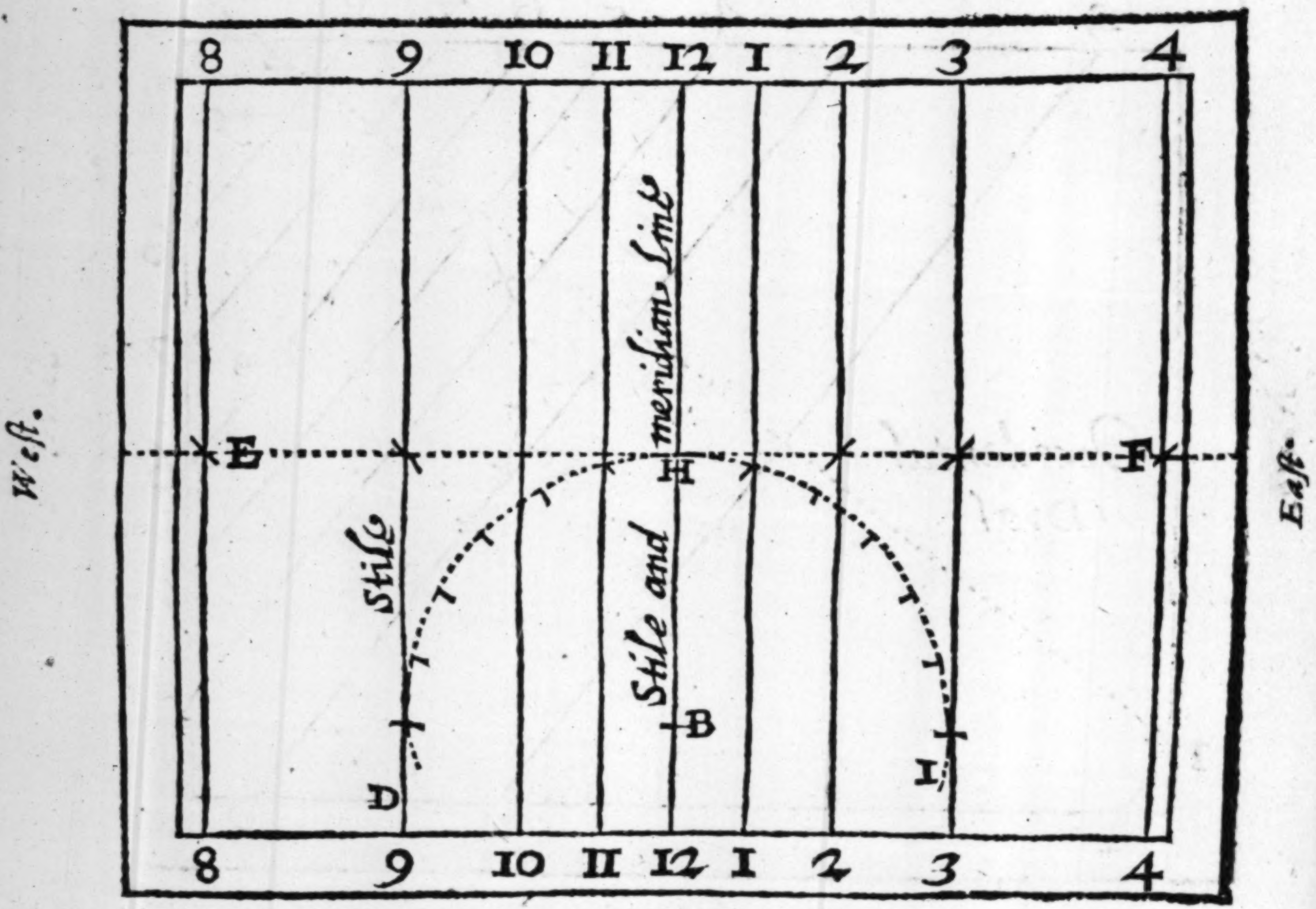
5.

A South direct dial reclining 38 degrees 30 minutes,

or a South direct polar dial.

6.



South, nether part.

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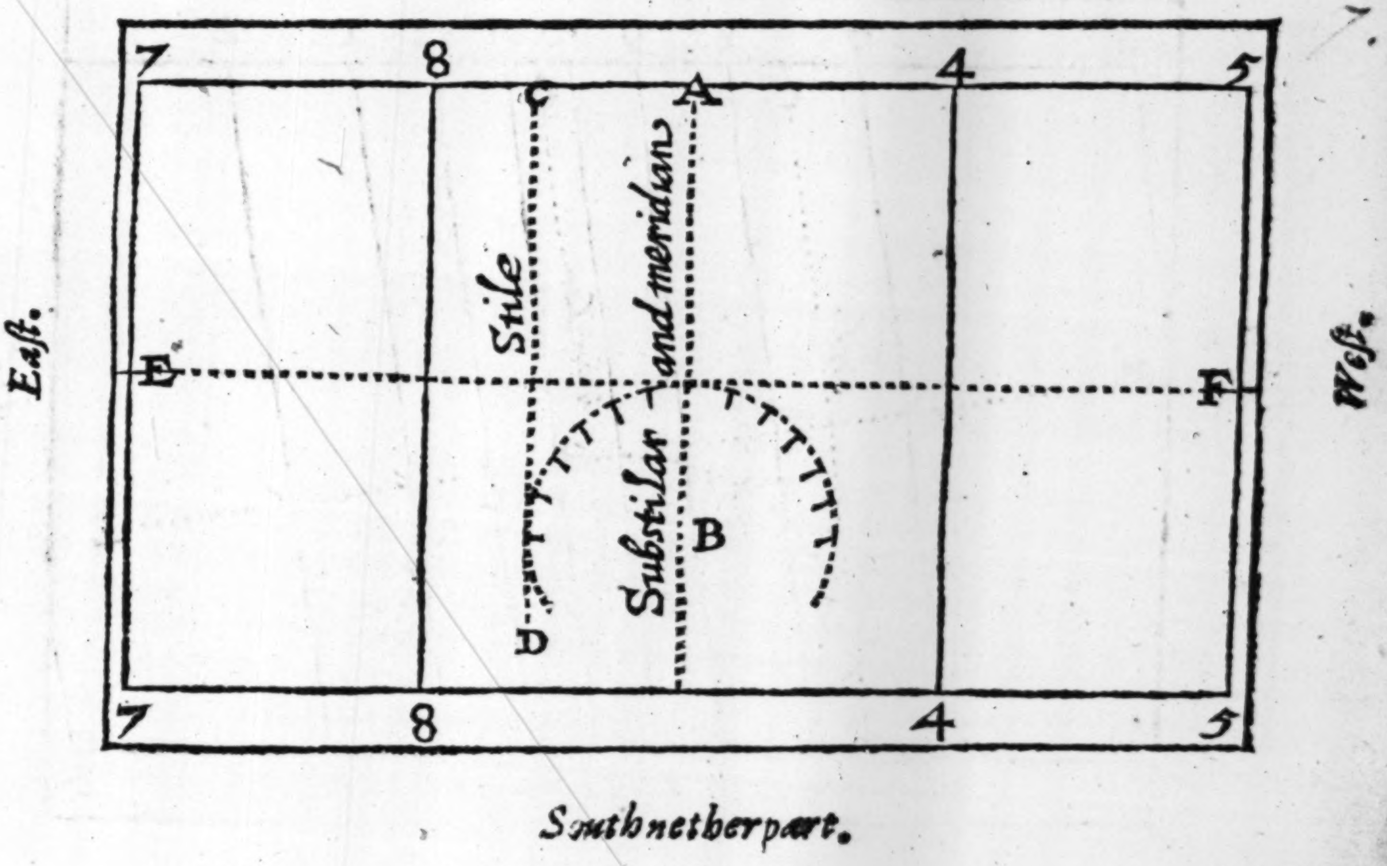
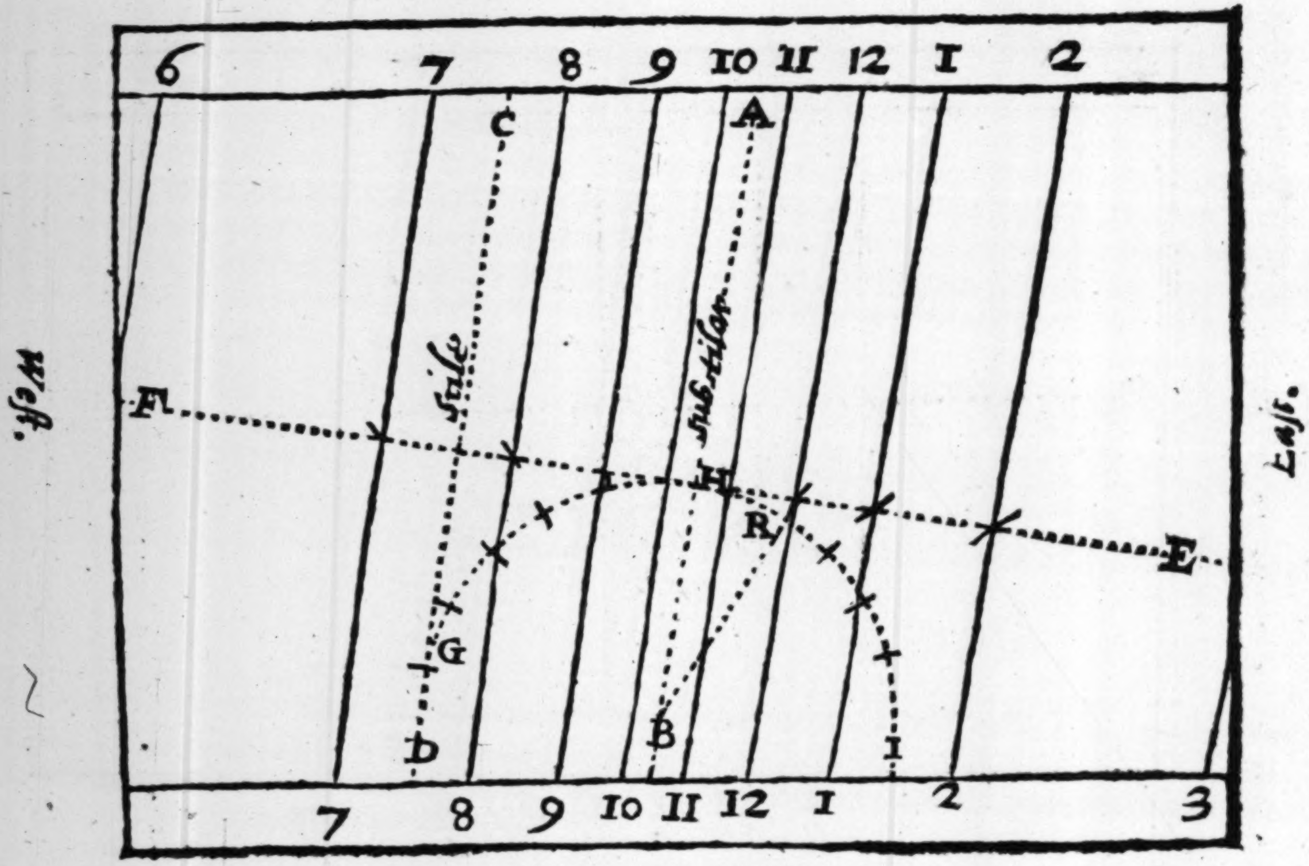
A North direct dial inclining 38 degrees 30. minutes, *or a North direct polar dial.*



F 3 South

South declining Eaſtward 27. degrees, reclining 34. *degrees* 40. *minutes.*



Southnetherpart.

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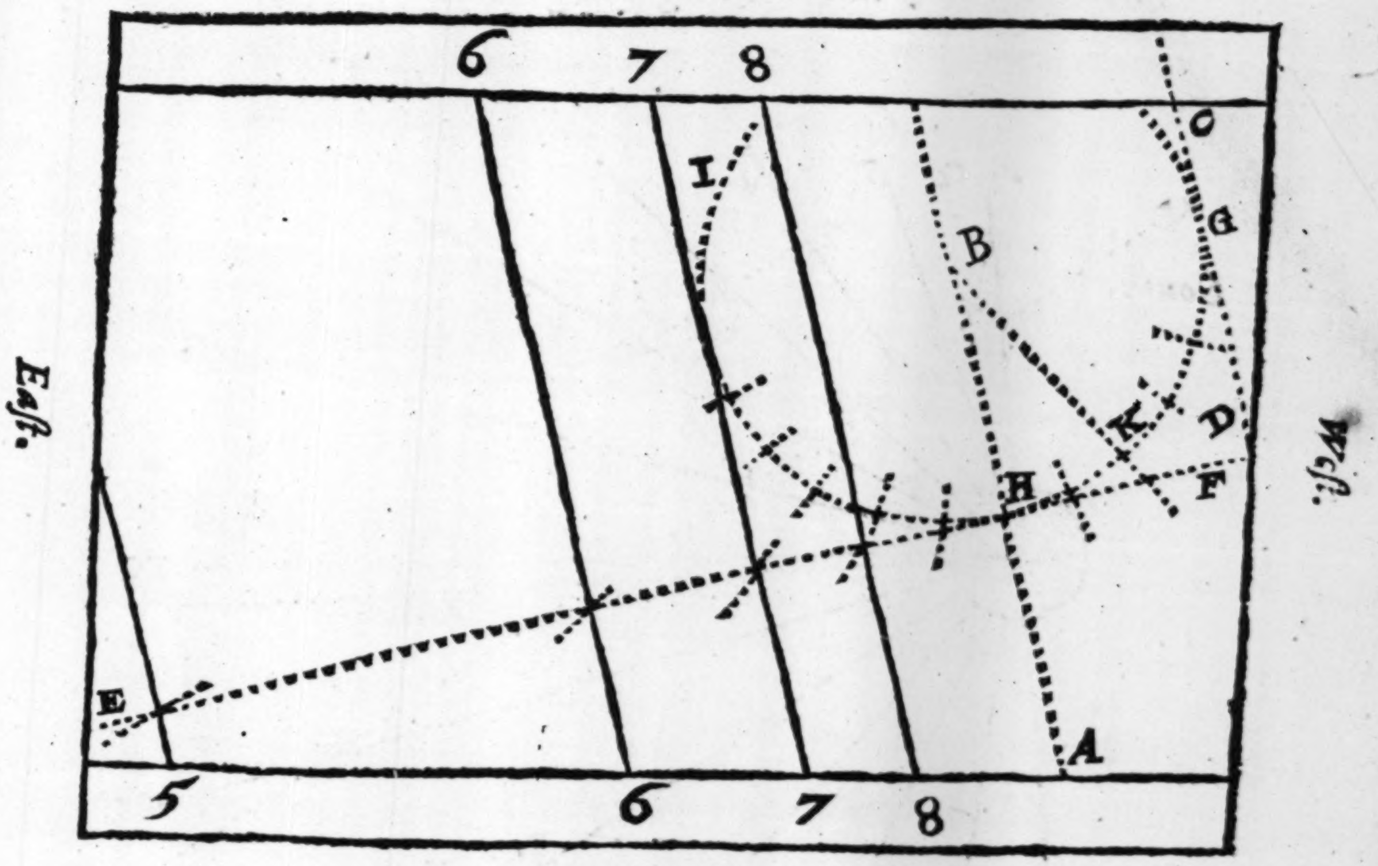
North

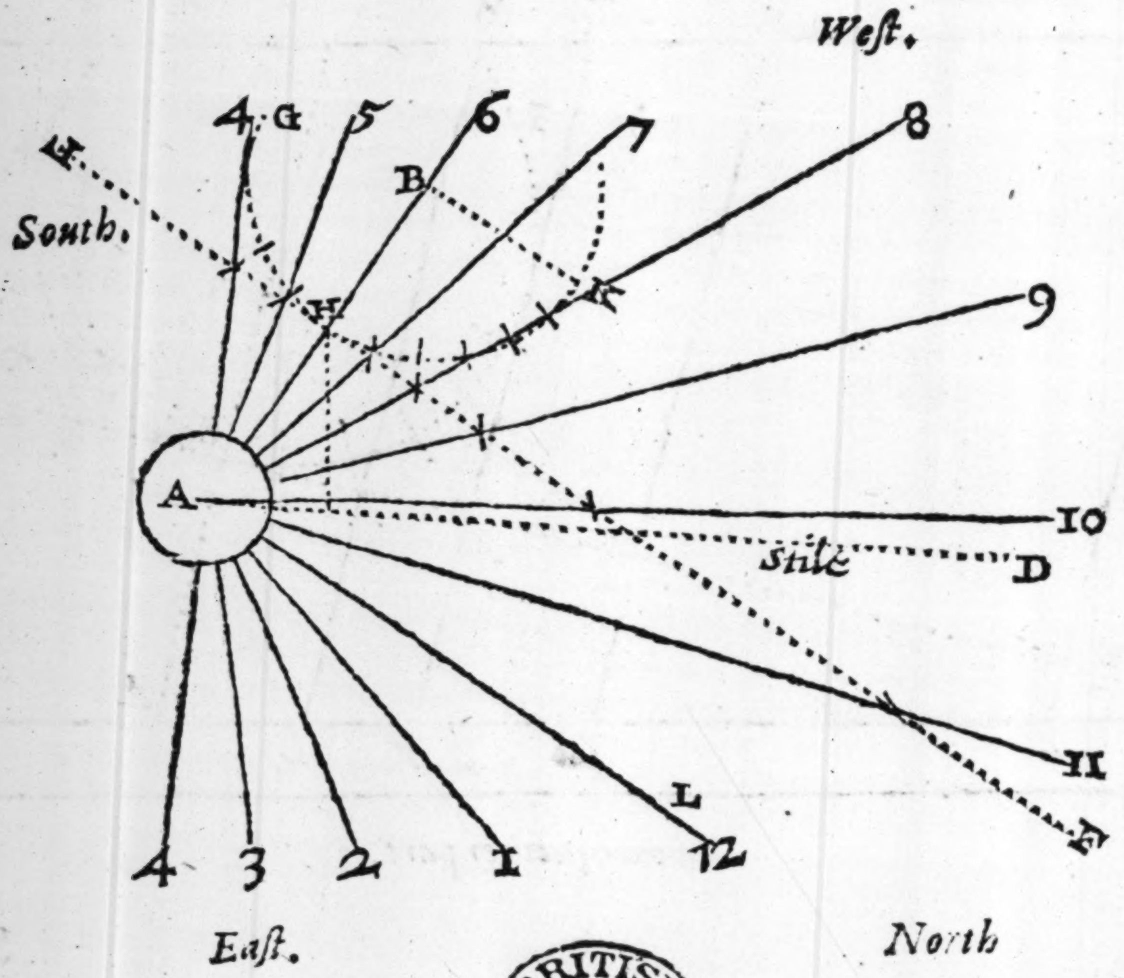
North declining Weſtward 36 degrees inclining 32. *degrees* 15 *minutes.*



South, nether part.

North declining Eaſtward 43. degrees reclining *42. degrees 20. minutes wherein the ſtile and meridian line make right angles.*

10.



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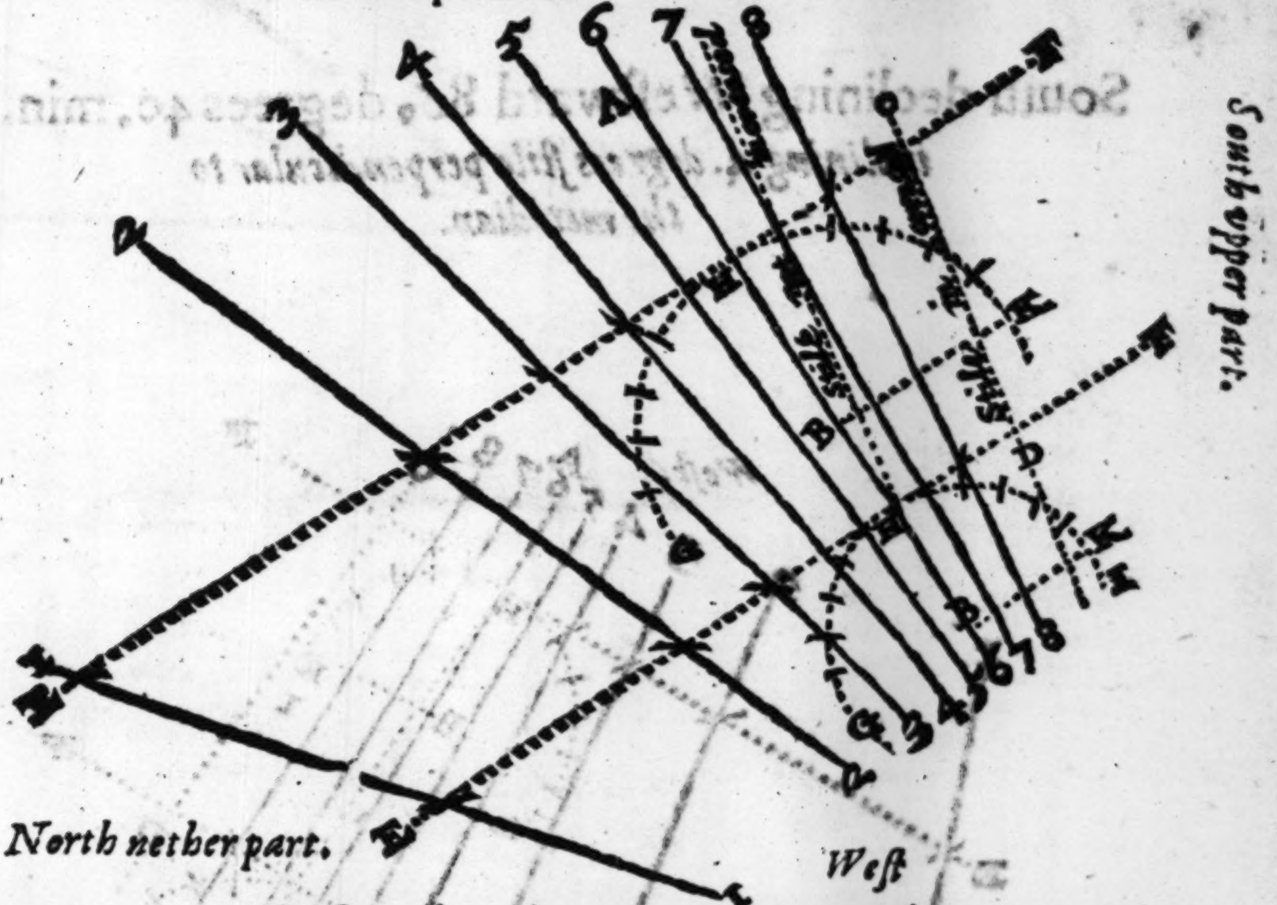
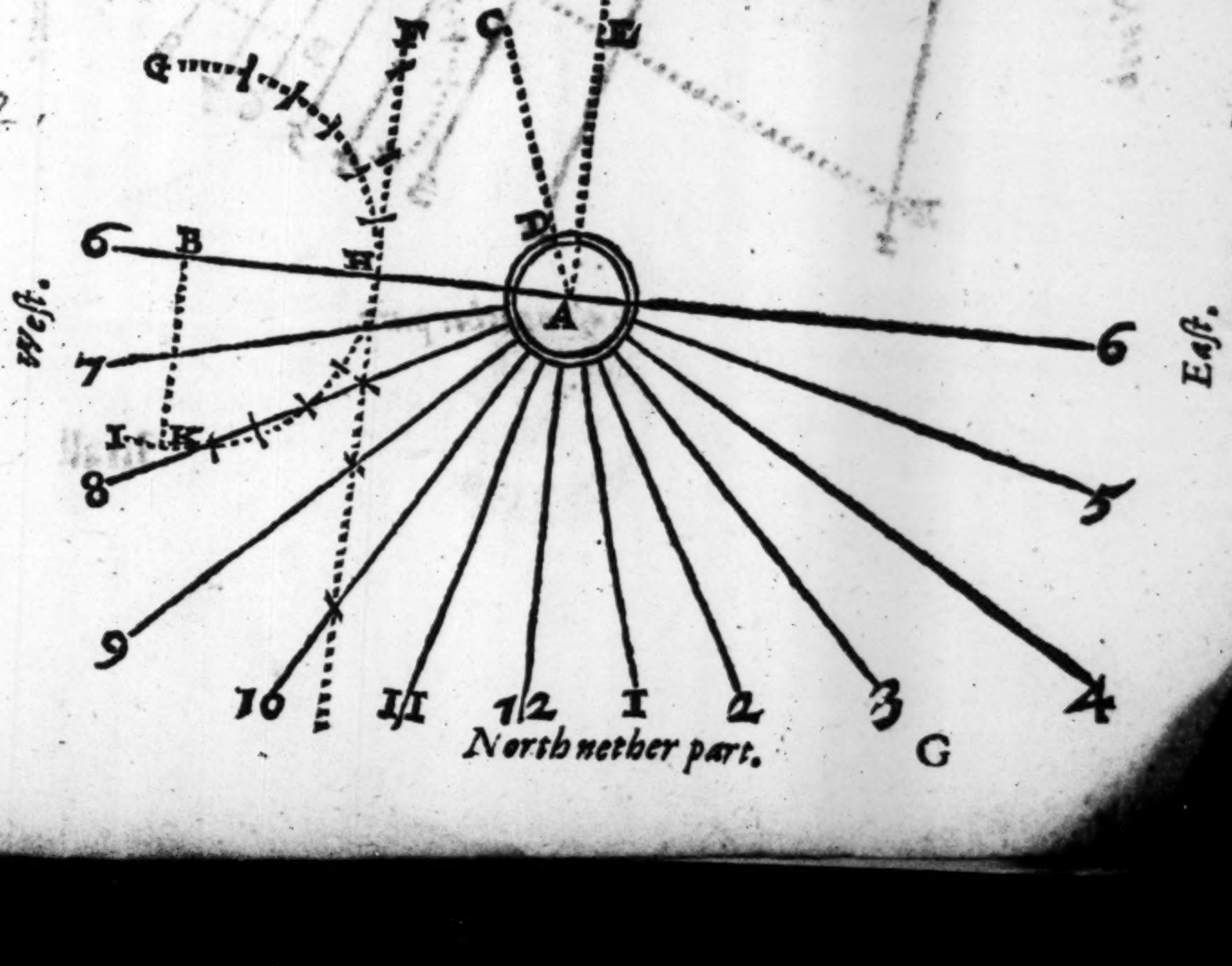
North declining 84. degrees weſtward, reclining 7 degrees 20 minutes, the ſtile pendicular to the Meridian line.

1.



South declining Eaſtward 31 degrees, inclining 48 degrees. 20 min. the ſtile perpendicular to the meridian.

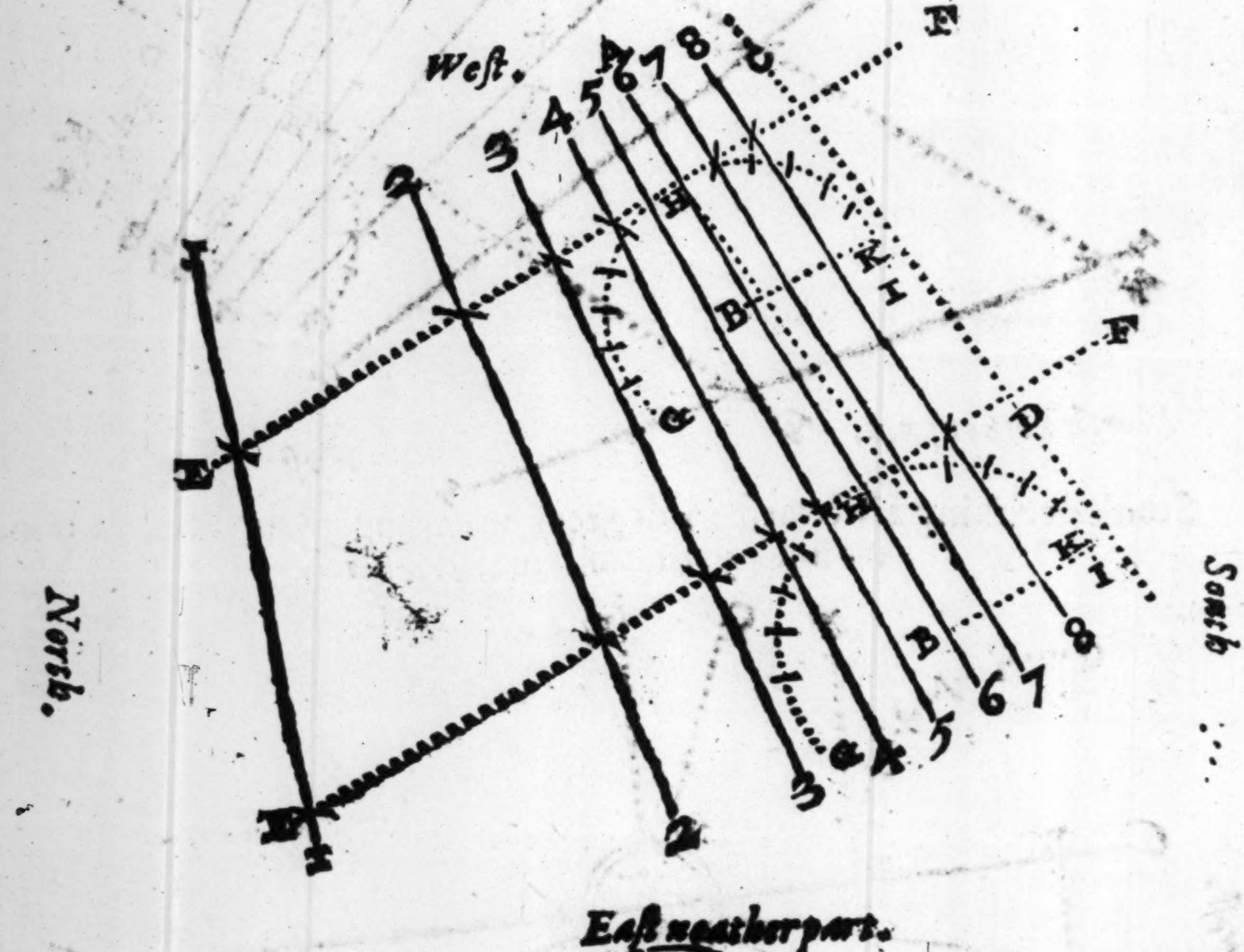
2.



G

South declining Weſtward 86. degrees 40. min.

inclining 4. degrees ſtile perpendicular to the meridian.



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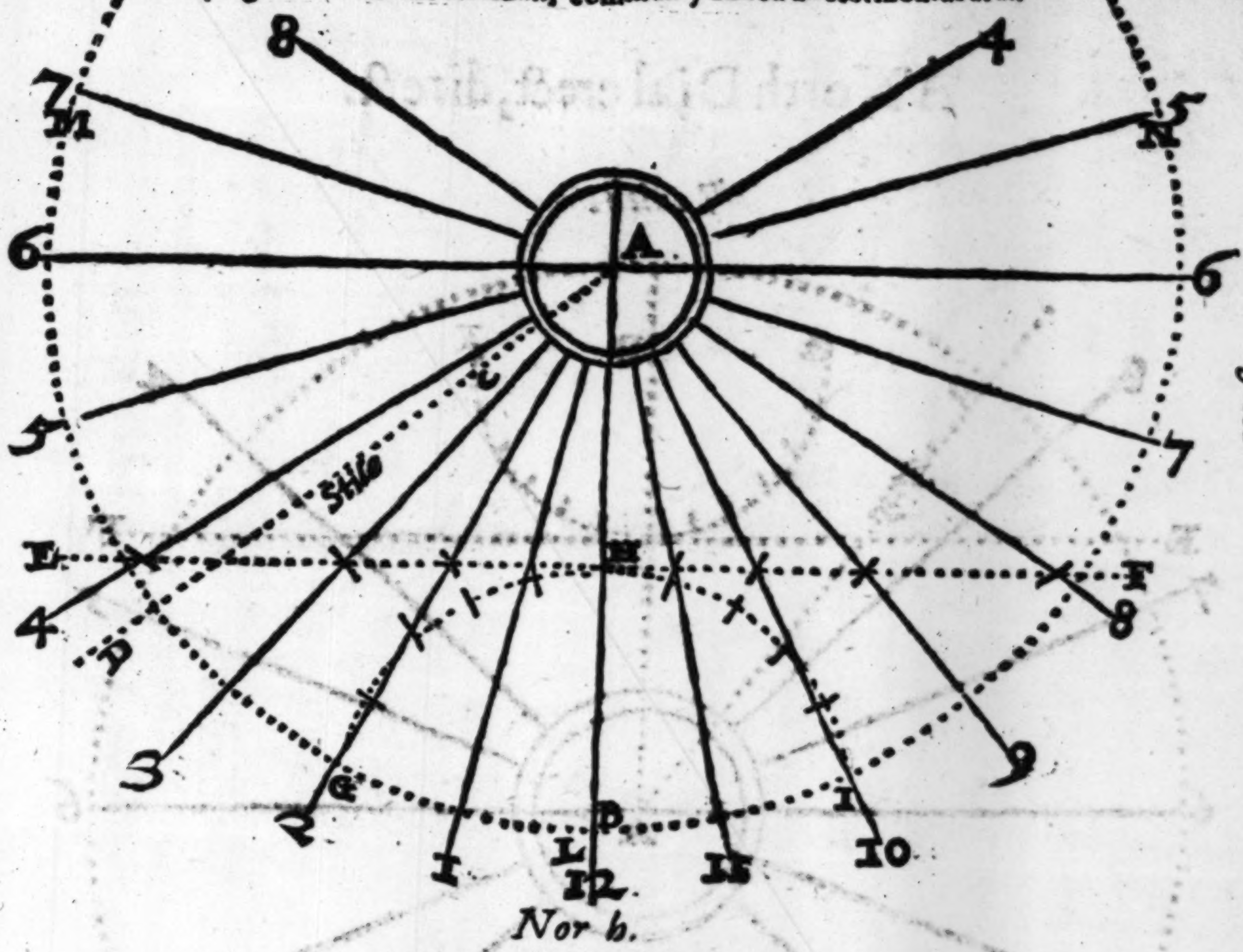
Inall

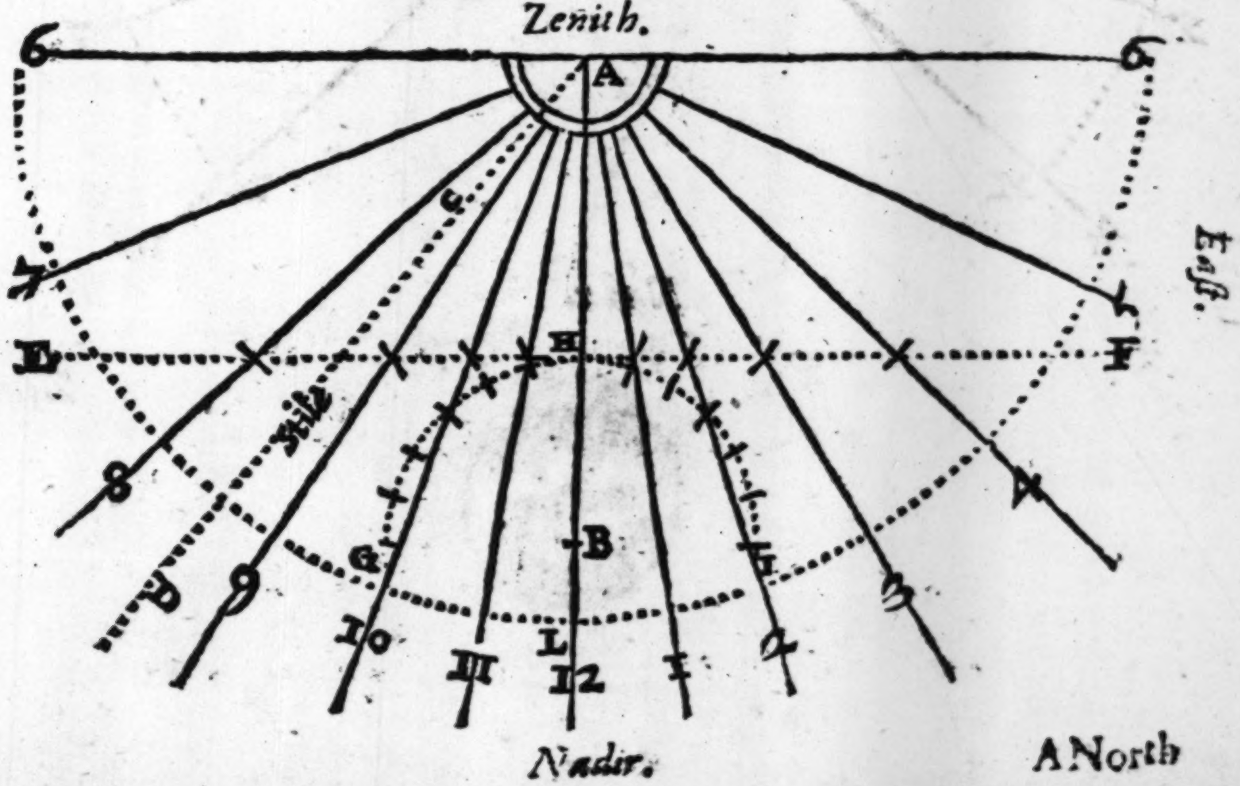
In all the figures following, the ſtile maketh a ſharpe angle with the meridian: a direct dial lying leuel with the Horizon, commonly called an Horizontal dial.

14



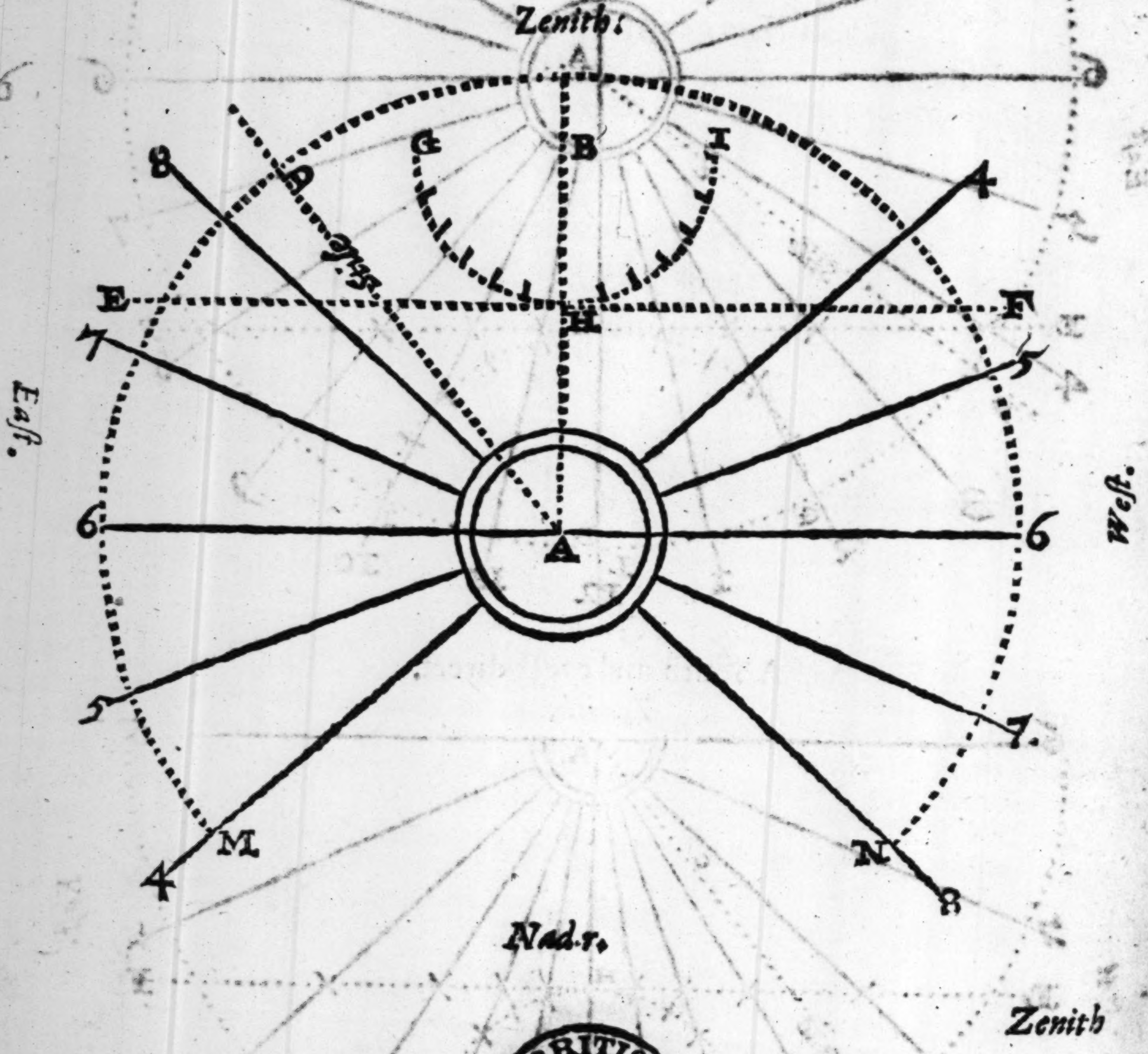
A South dial erect direct.

15



A North

A North Dial erect, direct.



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A South dial erect declining Eaſtward 30. degr.

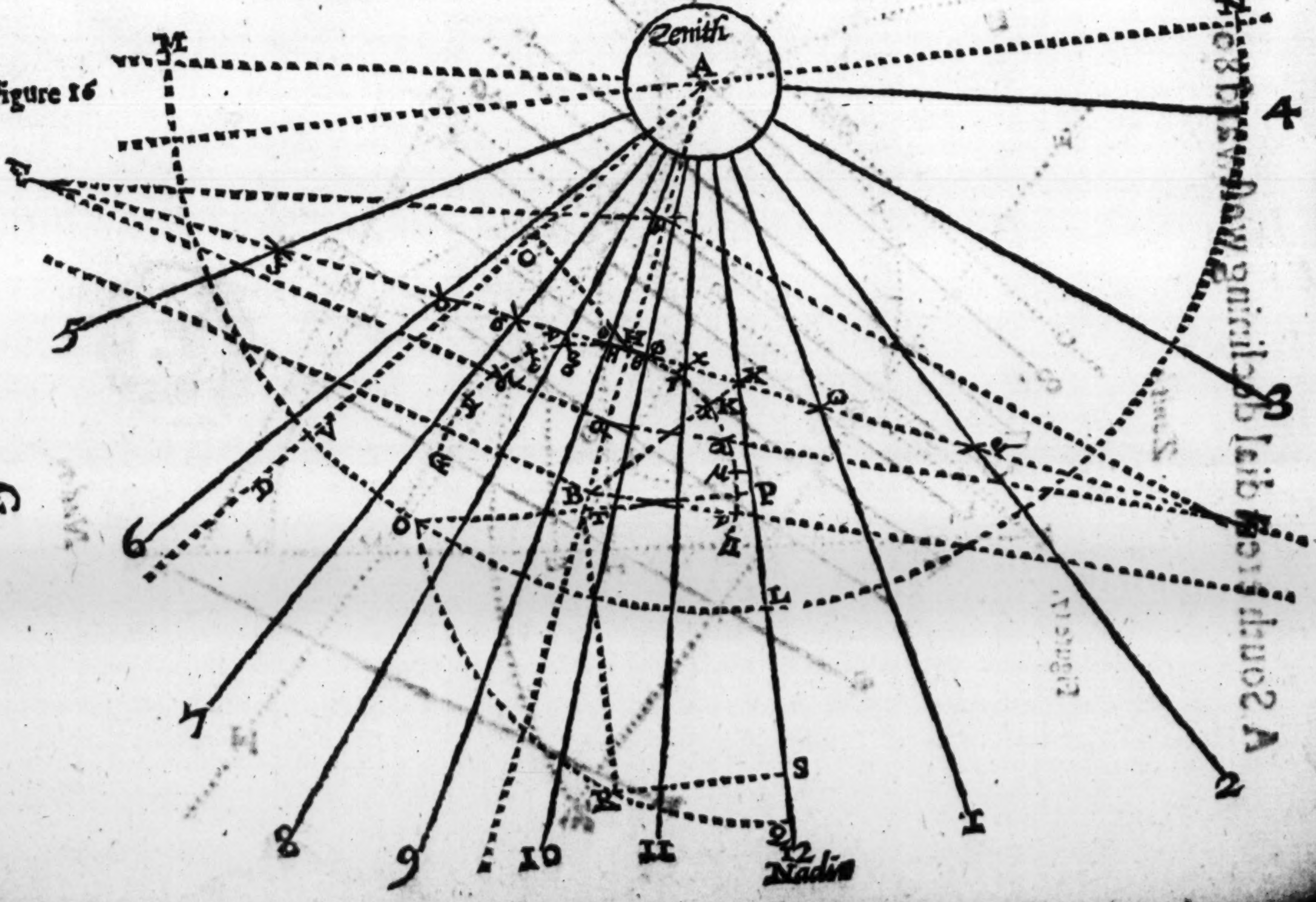
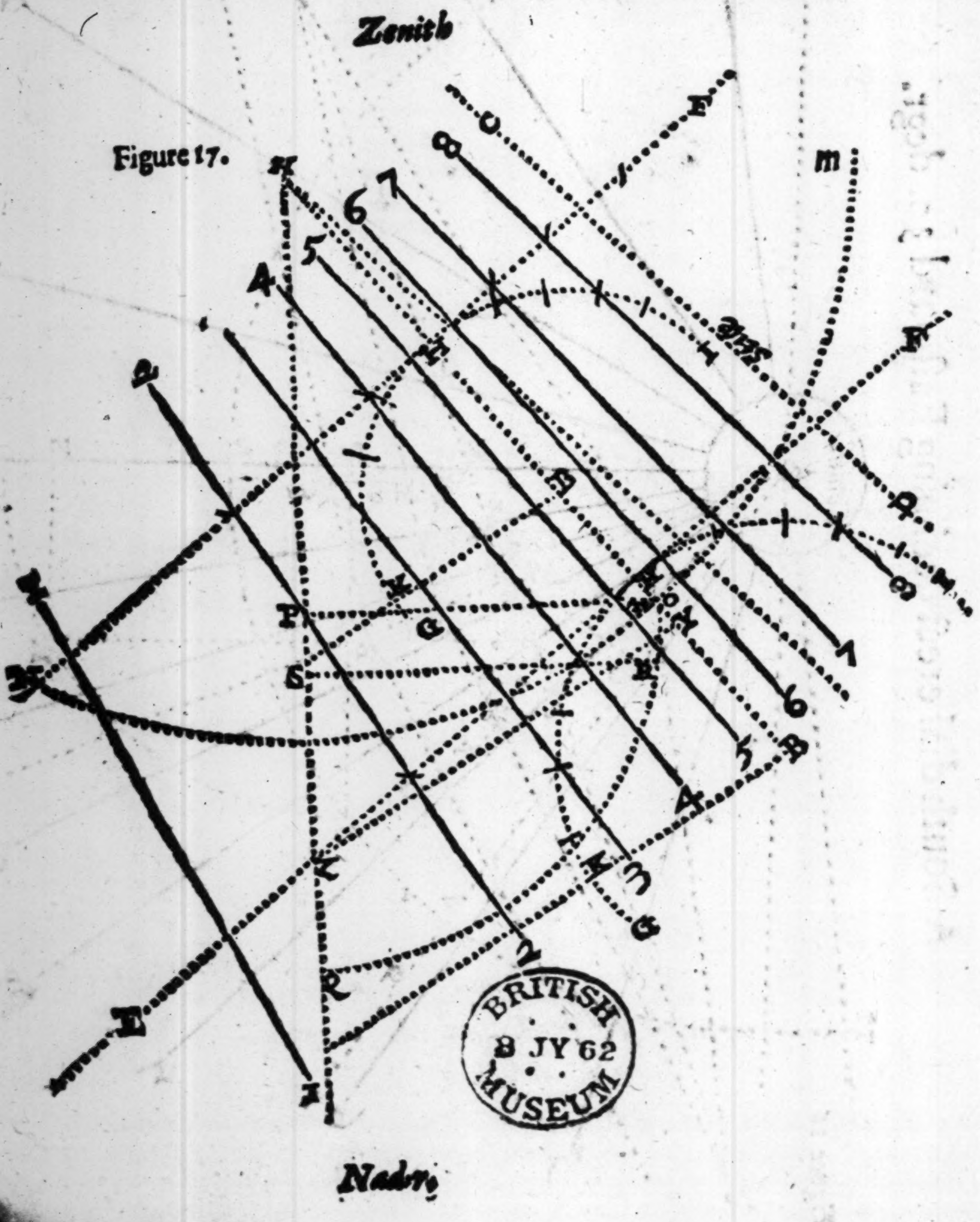


Figure 16

G

A South erect dial declining westward 80. degr.

Figure 17.



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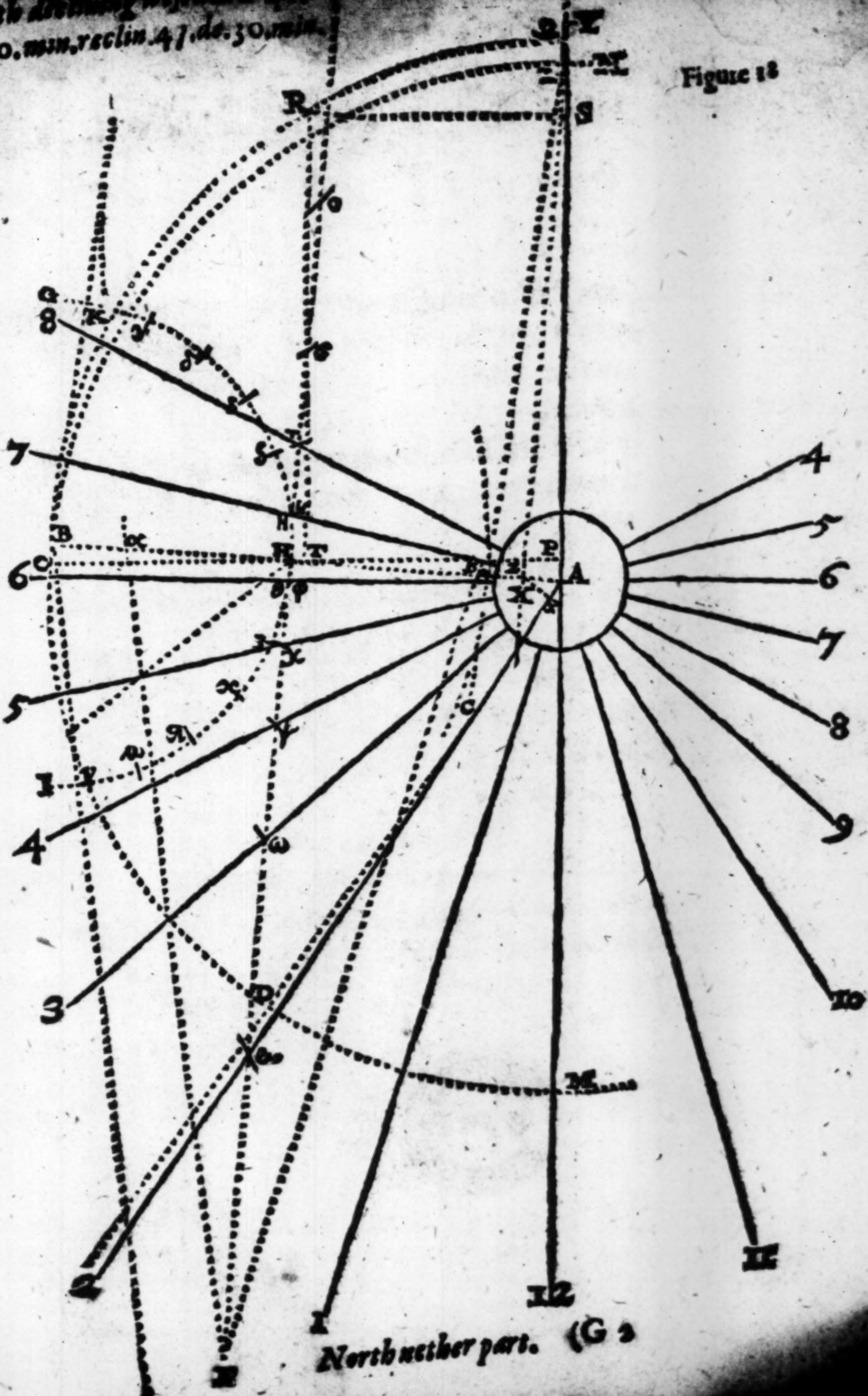
North declining [illegible]
de.40.min.reclin.47.de.30.min.

Figure 18

09



North nether part.

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THE

I

Whic
him,as h
of the w
would

Others
ments,
Ouid is
ſame, i
Me
A

THE OTHER AT TEMPLE BARRE.

Carried the frontiſpice of a Temple, the Wals of which and Gates were Braſſe; the Pillers Siluer, their Capitals and Baſes Golde: in the higheſt point of all was erected a *Ianus* head, and ouer it written.

IANO QVADRIFRONTI SACRVM.

Which title of *Quadrifrons* is ſaid to be giuen Baſſus a-
im, as he reſpecteth all Climates, and filles all parts pud Ma-
f the world with his Maieſtie; which *Martiall* cro. lib. 1. Saturn. ca. 9.
vould ſeeme to allude vnto in that *Hendicaſillable,*

Et linguâ pariter locutus omni. li. 8. Epi. 2.

Others haue thought it by reaſon of the foure Ele-
nents, which brake out of him, being *Chaos*: for
Ouid is not afraide to make *Chaos* and *Ianus* the
ame, in thoſe verſes

Me Chaos antiqui (nam ſum res priſca) vocabant Faſt. lib. 1.
Adſpice, &c.